PRELIMINARY RESULTS OF A RECREATIONAL USE ATTAINABILITY ANALYSIS OF AYISH BAYOU (0610A), EAST FORK OF THE ANGELINA RIVER (0611A), BILOXI CREEK (0604M), JACK CREEK (0604C) AND PAPER MILL CREEK (0615A)

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Summary

Ayish Bayou

Unclassified water body 0610A is a 41 mile stream that was evaluated with 21 RUAA field surveys and 70 recreational use interviews. It originates in the upstream perennial portion of the stream north of San Augustine in San Augustine County and flows south to the confluence with the Sam Rayburn Reservoir (Figure 1 and Appendix 1). The stream flows through rural areas that consist mostly of natural areas with some pastures that generally have riparian corridors. Forest (63%), pasture (16%) and mowed maintained corridor (9%) were the most frequently recorded riparian zones on Ayish Bayou followed by denuded eroded bank (6%).

All measurements during field surveys on Ayish Bayou were collected during a summer time period that had a mid-range Palmer drought index. Twenty three substantial pools were found on the 21 reaches surveyed. The average measured thalweg and stream width was 0.74 m and 6.62 m, respectively. The stream type was categorized as perennial (52%), intermittent with perennial pools (43%) and intermittent (5%). The flow was characterized as normal (100%) during all field surveys. All stream sites were wadeable during field surveys. Based on the TCEQ Wastewater Outfall shapefile, Ayish Bayou has 1 domestic sewage outfall less than 1 MGD (Million gallons per day) just south of San Augustine. One impoundment is located north of San Augustine on Ayish Bayou.

Based on 70 recreational use interviews, fifty three percent of the people that participated in the interviews and their families use Ayish Bayou for recreation. Among the interviewees that use the stream for recreation, 8% engage in primary contact recreational activities including swimming (3) and wading children (3). Sixty eight percent engaged in secondary contact 1 recreational activities including wading by adults (1), fishing for consumption (13), catch and release fishing (5), general fishing (11), kayaking (1), boating (2) and walking a dog that goes into the stream (1). Interviewees have witnessed recreational activities including primary contact recreation (2 reports of swimming and 1 report of hand fishing or noodling) and secondary contact recreation including multiple types of fishing and boating (39 total). Interviewees

characterized the dominant stream type as perennial (59%), intermittent with perennial pools (20%) and intermittent (20%). Most of the interviewees that do not use the stream for recreation have other personal interests (34%). Other reasons given for not using the stream were related to difficult access (11%), preferring to recreate in the lake or other water bodies (9%), poor access (9%), poor water quality (9%) and low water levels (9%).

No recreational activities were observed on Ayish Bayou during field surveys. A swimming aid and an inner tube were found on Ayish Bayou at survey sites 0610A.21 and 0610A.22, respectively. A volleyball and a soft ball were found in the stream at survey site 0610A.16 and 0610A.2, respectively. Eight articles of fishing tackle were found at seven survey sites in Ayish Bayou and two boats were found at survey sites 0610A.11 and 0610A.24. Shotgun shells (3 survey sites), a chair on the bank, a fire pit and a camping site were found along the stream. Foot prints, foot paths (2), stepping stones, a maintained trail, RV/ATV tracks (6), an ATV bridge and a road going to the stream were also found. Public lands on Ayish Bayou included a public park with a boardwalk in San Augustine and a national forest that supports a popular white bass run approximately two miles upstream from Sam Rayburn Reservoir. One interviewee stated that twenty or more people per day fish in the stream for white bass for at least a month each spring. General public access was estimated to be moderate.

East Fork of the Angelina River

Unclassified water body 0611A is a 29 mile stream that was evaluated with 13 RUAA field surveys and 62 recreational use interviews. It originates in the upstream perennial portion of the stream west of Mount Enterprise in Rusk County and flows west to the confluence with the Angelina River at the Rusk/Nacogdoches county line. The stream flows mostly through forested areas and comes in contact with a few pastures. Forest (74%) and pasture (11%) were the dominant recorded riparian corridors on the East Fork of the Angelina River.

All measurements during field surveys on the East Fork of the Angelina River were collected during a summer time period that had a mid-range Palmer drought index. Seven substantial pools were found on the 13 reaches surveyed. The average measured thalweg and stream width

was 0.78 m and 7.1 m, respectively. The stream type was categorized as perennial (85%) and intermittent with perennial pools (15%). The flow was characterized as normal (85%), high (8%) and low (8%). All stream sites were wadeable during field surveys. Based on the TCEQ Wastewater Outfall shapefile, no wastewater outfalls are located on the stream. One impoundment is located approximately 3.5 miles northeast of Cushing on the East Fork of the Angelina River.

Based on 62 recreational use interviews, forty two percent of the people that participated in the interviews and their families use the East Fork of the Angelina River for recreation. Among the interviewees that use the stream for recreation, 23% engage in primary contact recreational activities including swimming (6). Seventy seven percent engage in secondary contact 1 recreational activities including fishing for consumption (3), catch and release fishing (6), general fishing (10), kayaking (1) and boating (1). Interviewees have witnessed recreational activities including primary contact recreation (2 reports of swimming) and secondary contact recreation including wading by adults (1), fishing for consumption (3), catch and release fishing (7) and general fishing (12). Interviewees characterized the dominant stream type as perennial (72%), intermittent with perennial pools (16%) and intermittent (12%). Most of the interviewees that do not use the stream for recreation have other personal interests (43%). Other reasons given for not using the stream were related to low or no water (16%), potentially dangerous wildlife (14%) and not being familiar with the stream (11%).

No primary contact or secondary contact recreational activities were observed on the East Fork of the Angelina River by technicians during the field surveys. Two rope swings were found on the East Fork of the Angelina River at survey sites 0611A.5 and 0611A.13. Four articles of fishing tackle were found at four survey sites. Evidence of target practice (a metal can with bullet holes), shotgun shells and a hunting stand were found at two different survey sites. Foot prints, a foot path and RV/ATV tracks at 6 survey sites were also found. General public access was estimated to be moderate.

Biloxi Creek

Unclassified water body 0604M is a 28 mile stream that was evaluated with 15 RUAA field surveys and 31 recreational use interviews. It originates near FM 325 east of Lufkin in Angelina County and flows south to the confluence with the Neches River southeast of Diboll. The stream generally flows through pastures and forested parcels immediately east and southeast of the city of Lufkin and increasingly flows through forested areas in its middle reaches and southern most extent. Forest (77%) and pasture (15%) were the most frequently recorded riparian zones on Biloxi Creek followed by mowed/maintained corridor (5%).

All measurements during field surveys on Biloxi Creek were collected during a summer time period that had a mid-range Palmer drought index. Four substantial pools were found on the 15 reaches surveyed. The average measured thalweg and stream width was 0.50 m and 4.27 m, respectively. The stream type was categorized as intermittent (53%), perennial (33%) and intermittent with perennial pools (13%). The flow was characterized as normal (67%), no flow (27%) and high (7%). All stream sites were wadeable during field surveys. Based on the TCEQ Wastewater Outfall shapefile, no wastewater outfalls are located on the stream. One impoundment is located in the upper reaches of Biloxi Creek.

Based on 31 recreational use interviews, forty two percent of the people that participated in the interviews and their families use Biloxi Creek for recreation. Among the interviewees that use the stream for recreation, 15% engage in primary contact recreational activities including swimming (3) and wading by children (2). Thirty eight percent engage in secondary contact 1 recreational activities including fishing for consumption (1), catch and release fishing (2), general fishing (1) and family dogs going in the stream (1). Interviewees have witnessed secondary contact 1 recreational activities including wading by adults (1), fishing for consumption (1) and fishing for crawfish (1). Interviewees characterized the dominant stream type as intermittent (44%), perennial (32%) and intermittent with perennial pools (24%). Most of the interviewees that do not use the stream for recreation have other personal interests (22%) or think it does have enough water (Low water levels, 22%). Other reasons given for not using the stream were related to poor water quality (14%), interviewee prefers to recreate on other water bodies (8%) and steep banks (8%).

No primary contact recreational activities were observed in Biloxi Creek during field surveys. Secondary contact recreational 1 activities were recorded on Biloxi Creek and included family dogs that were swimming in the stream at survey points 0604M.4 and 0604M.5. Noncontact recreational activities observed during field surveys on Biloxi Creek included the use of an ATV at survey point 0604M.5 and hunting at survey point 0604M.10. A tree vine used similar to a rope swing (vine swing) was photographed on Biloxi Creek and is currently being used by children based on an interview conducted with the property owner. Young children's toys were found at survey sites 0604M.7 and 0604M.12 in Biloxi Creek as well as a tennis and soccer ball at survey sites 0604M.3 and 0604M.4, respectively. One article of fishing tackle, a half buried boat in the stream channel (survey site 0604M.13), shotgun shells (3 survey sites), a hunting blind, a deer stand, a deer feeder with a wildlife camera and graffiti on a bridge were found in and along Biloxi Creek. RV/ATV tracks (2 survey sites), vehicle tracks, a pavilion with a barbeque pit and small bridge crossing the stream were also found. General public access was estimated to be moderate.

Jack Creek

Unclassified water body 0604C is a 16 mile stream that was evaluated with 9 RUAA field surveys and 28 recreational use interviews. It originates in the upstream perennial portion of the stream northeast of Lufkin in Angelina County and flows south to the confluence with Cedar Creek southwest of Lufkin. The stream flows through rural areas that consist of forested parcels and pastures that generally have forested corridors. Forest (73%), pasture (9%), mowed maintained corridor (9%) and marsh (9%) were the dominant riparian zones recorded on Jack Creek.

All measurements during field surveys on Jack Creek were collected during a summer time period that had a mid-range Palmer drought index. Five substantial pools were found on the 9 reaches surveyed. The average measured thalweg and stream width was 0.49 m, and 4.39 m, respectively. The stream type was categorized as perennial (67%), intermittent with perennial pools (22%) and intermittent (11%). The flow was characterized as normal (78%) and no flow (22%). All stream sites were wadeable during field surveys. Based on the TCEQ Wastewater

Outfall shapefile, Jack Creek has 1 domestic sewage outfall less than 1 MGD in the vicinity of Hudson. Two impoundments are located in the upper reaches of Jack Creek.

Based on 28 recreational use interviews, thirty nine percent of the people that participated in the interviews and their families use Jack Creek for recreation. Among the interviewees that use the stream for recreation, 46% engage in primary contact recreational activities including swimming (8) and wading by children (4). Eighteen percent engage in secondary contact 1 recreational activities including wading by adults (2), general fishing (1) and family dogs going into the stream (1). Interviewees have witnessed recreational activities including primary contact recreation (5) and wading by children (5). Secondary contact recreation witnessed includes wading by adults (2), general fishing (1) and fishing for crawfish (1). Interviewees characterized the dominant stream type as perennial (64%), intermittent (14%) and intermittent with perennial pools (9%). Most of the interviewees who do not use the stream state that the stream has low or no water (28%). Other reasons given for not using the stream were related to other personal interests (24%), not being familiar with the stream (17%) and poor water quality (14%).

Primary contact recreational activities were observed in Jack Creek in which wading children were observed at survey point 0604C.3. Noncontact recreation involving the use of an ATV next to the stream was also observed at this survey site. An inner tube was found in the stream at survey site 0604C.11 as well as a young child's toy at survey site 0604C.4. A hunting blind, shoes on the bank, a foot path and RV/ATV tracks were also found along the stream. General public access was estimated to be moderate.

Paper Mill Creek

Unclassified water body 0615A is a 7 mile stream that was evaluated with 4 RUAA field surveys and 9 recreational use interviews. It originates in the upstream perennial portion of the stream northeast of Lufkin in Angelina County and flows northeast to the confluence with the Angelina River before flowing into the Sam Rayburn Reservoir. The stream flows mostly through forest over the entire length of the stream. Forest (73%), denuded eroded bank (18%) and pasture (9%) were the most frequently recorded riparian zones on Paper Mill Creek.

All measurements during field surveys on Paper Mill Creek were collected during a summer time period that had a mid-range Palmer drought index. Three substantial pools were found on the 4 reaches surveyed. The average measured thalweg and stream width was 0.57 m and 4.63 m, respectively. The stream type was categorized as perennial (75%) and intermittent (25%). The flow was characterized as normal (75%) and flooded (25%). Three out of the four stream sites were wadeable during field surveys. Based on the TCEQ Wastewater Outfall shapefile, no wastewater outfalls were found on the stream. No impoundments were found on Paper Mill Creek.

Based on 9 recreational use interviews, forty four percent of the people that participated in the interviews and their families use Paper Mill Creek for recreation. Among the interviewees that use the stream for recreation, 50% engage in secondary contact recreational activities including fishing for consumption (1) and general fishing (1). No interviewees or their family use the stream for primary contact recreation. Interviewees have witnessed one instance of general fishing (1). Interviewees characterized the dominant stream type as perennial (78%) and intermittent with perennial pools (11%). Based on the answers from four interviews, 3 interviewees do not use the stream for recreation due to poor water quality and one interviewee stated they do not use the stream due to poor access relating to private property.

No recreational activities were observed on Paper Mill Creek during field surveys. Two hunting blinds, a trail, one set of RV/ATV tracks, and a road going to the stream were recorded along Paper Mill Creek during surveys. General public access was estimated to be very limited.

Introduction

Section 101(a)(2) of the Federal Water Pollution Control Amendments of 1972 or the Clean Water Act (the Act) states it is the national goal, wherever attainable, to provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the waters of the United States. Under section 131.10(j) of the Water Quality Standards Regulation of the United States Environmental Protection Agency (EPA), states are required to conduct a use attainability analysis (UAA) whenever the state designates uses of water bodies that do not include the uses specified in section 101(a)(2) of the Act, removes one of these designated uses, or adopts subcategories of these uses that require less stringent criteria.

A UAA (or RUAA) is a structured scientific assessment of the factors affecting the attainment of a use on a water body. The overall purpose of a RUAA is to make sure streams have the correct recreational use classification following the guidelines established in the Act. The ultimate goal is that the new designated use classification is more accurate.

RUAAs may include physical, chemical and biological evaluations to determine what factors impair attainment of designated uses and provide information to determine what uses are appropriate and feasible for the water body in question. Important factors in such analyses can include naturally occurring pollutant concentrations, anthropogenic sources of pollution, water depth, hydrological modifications and natural physical characteristics of streams that could impair the use. In addition, RUAAs typically assess the current uses (recreation and otherwise) of the water bodies under evaluation.

States use the information collected in a RUAA to demonstrate to the EPA that attaining the uses in section 101(a)(2) are not feasible because:

1. naturally occurring pollutant concentrations prevent the attainment of the use;
2. natural, ephemeral, intermittent or low- flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met;

3. human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;
4. hydrologic modifications preclude the attainment of the use and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use;
5. physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to [chemical] water quality, preclude attainment of aquatic life protection uses; or
6. controls more stringent than those required by sections 30l(b)(l)(A) and (B) and 306 of the Act would result in substantial and widespread economic and social impact.

On June 27 through August 10, 2014, a team from Texas AgriLife Research, Texas A&M University System, carried out RUAAs for Ayish Bayou (0610A), the East Fork of the Angelina River (0611A), Biloxi Creek (0604M), Jack Creek (0604C) and Paper Mill Creek (0615A) (Figures 1-6, Table 1). Following the methodology in TCEQ's 2014 Recreational Use Attainability Analysis Procedures, team members talked with landowners on these streams, interviewed recreational users and collected data. The Water Quality Standards Group within the TCEQ will use this information to potentially classify or reclassify streams in the categories of primary contact recreation, secondary contact 1 recreation, secondary contact 2 recreation and non-contact recreation.

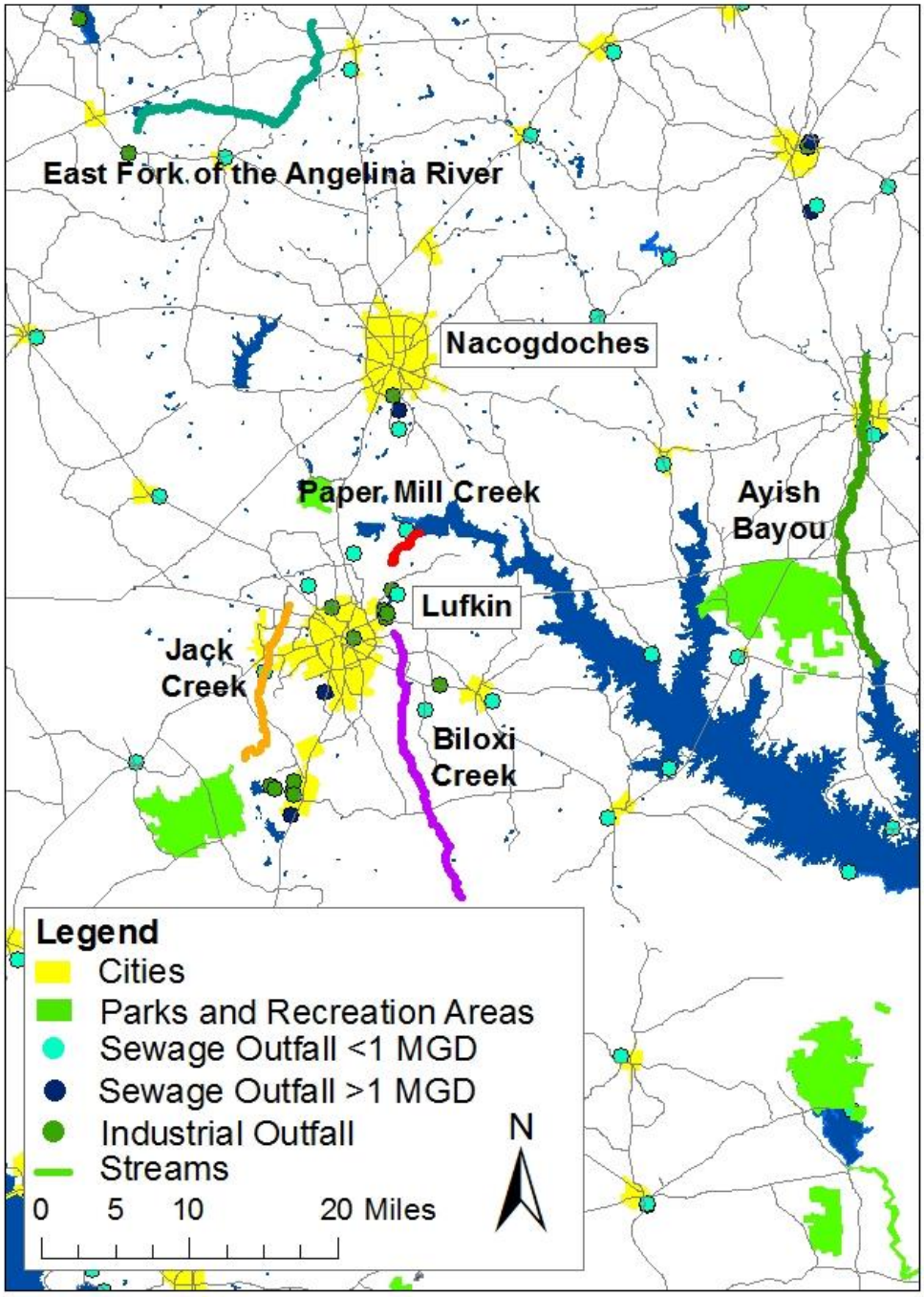

Figure 1. Map of RUAA streams with cities, parks, major roads, wastewater outfalls and reservoirs.

Figure 2. Photograph of Ayish Bayou (Water body 0610A) at RUAA survey site 0610A.9 on June 29, 2014.

Figure 3. Photograph of the East Fork of the Angelina River (Water body 0611A) at RUAA survey site 0611A.12 on August 10, 2014.

Figure 4. Photograph of Biloxi Creek (Water body 0604M) at RUAA survey site 0604M.10 on July 5, 2014.

Figure 5. Photograph of Jack Creek (Water body 0604C) at RUAA survey site 0604C.4 on July 5, 2014.

Figure 6. Photograph of Paper Mill Creek (Water body 0615A) at RUAA survey site 0615A.3 on June 25, 2014.

Table 1. General RUAA stream characteristics.

Stream	Water body name	Stream type	Description	Total stream miles	# of surveys
0610A	Ayish Bayou	Unclassified	From the confluence of Sam Rayburn Reservoir south of San Augustine in San Augustine County to the upstream perennial portion of the stream north of San Augustine in San Augustine County.	41	21
0611A	East Fork of the Angelina River	Unclassified	From the confluence of the Angelina River at the Rusk/Nacogdoches county line to the upstream perennial portion of the stream west of Mount Enterprise in Rusk County.	29	13
0604M	Biloxi Creek	Unclassified	From the confluence with the Neches River southeast of Diboll to FM 325 east of Lufkin in Angelina County.	28	15
0604C	Jack Creek	Unclassified	From the confluence of Cedar Creek southwest of Lufkin in Angelina County to the upstream perennial portion of the stream in northeast Lufkin in Angelina County.	16	9
0615A	Paper Mill Creek	Unclassified	From the confluence of Sam Rayburn Reservoir (Angelina River Arm) northeast of Lufkin in Angelina County to the upstream perennial portion of the stream in Lufkin in Angelina County.	7	4
Total				**121**	**62**

Methods

Creation of a GIS Project

An ESRI ArcMap GIS project was created to acquire the information needed to carry out the RUAA site surveys. Stream shapefiles were obtained from TCEQ. Shapefiles of Texas counties, cities, major roads and stream point sources (TCEQ Wastewater Outfalls) were obtained from (TCEQ's Atlas of Texas Surface Waters). A watershed shapefile (basinspy) was obtained from Texas Parks and Wildlife. Aerial photographs (NAIP12 nc-cir 1m) and street shapefiles were obtained from the Texas Natural Resources Information System. Shapefiles (polygons) of private property parcels were obtained from county property appraiser offices. Shapefiles of public recreation areas were obtained from the Texas Parks and Wildlife Department (TPWD) and Texas General Land Office (TGLO). These included TPWD parks (parkpy.shp and tpwdparks.shp), state preserves (preserves.shp), sanctuaries managed by the Audubon Society (sanctuaries.shp) and wildlife refuges managed by the U.S. Fish and Wildlife Service (wildliferefuges.shp).

Photograph Naming Convention

In sequence, photograph names (i.e. 1.9_Dwn150_0610A.1_06272014_152222) provide the camera number, a period, a photo number assigned by the camera, an underscore, a code which describes the contents of the photograph, the location in meters along the stream reach where the photograph was taken, an underscore, the segment identification code for the specific survey site, an underscore, the date and the time of day to the nearest second in military time. Photographs taken at locations other than 0, 150 or 300 meters along the reach do not have reach location (distance along the reach) information. The example photograph name above was taken by camera 1, was the 9th photograph assigned by the camera, was depicting a downstream photograph of the stream 150 meters along the reach at survey site 0610A.1 (Survey site 1 on Ayish Bayou (0610A)). This example photograph was taken on June 27, 2014 at 15:22 (3:22 pm) and 22 seconds. Content codes include Up (up stream), Dwn (down stream), LB (left bank), RB (right bank), HP (human presence), IHU (indications of human use), IPC (indication of

primary contact recreation), SC (surrounding conditions), SPA (site/public access), PR (promote recreation), PP (public park), IR (impede recreation), G (garbage or debris), UC (unsafe condition), CO (channel obstructions), FPS (flowing point source or NPDES discharge), HM (hydrologic modifications), Dam (dam or on channel impoundment), W (wildlife or animal evidence (not related to sustained aquatic habitat)) and SAH (sustained aquatic habitat).

Sampling Design and Site Selection

Systematic and purposive sampling methods were used to select survey sites on project streams. Using TCEQ stream shapefiles, survey stations were generally evenly spaced every 1.67 miles or 3 points per 5 mile segment of stream. This methodology ensured that the survey sites provide a representative sample of the conditions that exist along the entire population of streams. In order to ensure that recreational use was targeted for measurement, evenly spaced points were replaced with sites near these points where recreation was most likely to occur. These targeted areas of recreational use included public parks, bridges and other areas that are accessible to recreational users. Every effort was made to survey all sites. Some survey sites however, were not sampled due to the lack of permission from private property owners. In these cases, alternative sites were found and surveyed whenever possible.

Collected Data for Each Stream Survey Sites

Field data was collected based on TCEQ's Recreational Use Attainability Analyses Procedures for a Basic RUAA Survey (2014). Following these procedures, Contact Information Forms (Appendix 2), RUAA Summaries (Appendix 5), Field Data Sheets (Appendix 3) and RUAA Interview Forms (Appendix 4) were completed for each RUAA stream survey site. Monthly Palmer Drought Index data was obtained NOAA's National Climatic Data Center's Climate Monitoring (Historical Palmer Drought Indices). Daily precipitation data was obtained from (NOAA's National Climatic Data Center). Averaged daily precipitation data was used to produce preceding 30 day, 7 day and 1 day precipitation summary statistics.

Statistical Analyses

Basic statistical analyses were used to summarize collected RUAA data. Quantitative data such as average thalweg and average precipitation were determined by calculating the mean. Categorical data was summarized by counting the number of occurrences or calculating the proportion of occurrences out of the total number recorded.

Completion of RUAA Summaries

The average thalweg for each stream was determined by calculating the mean thalweg for each survey site and then the mean of these means for each stream. Microsoft Autofilter was used to sort the data and determine which streams had substantial pools deeper than 1 m. Observations on use and the general level of public access were determined by using multiple sources of information. Observations on use including primary contact, secondary contact (1 & 2) and noncontact recreation activities were primarily determined by considering information provided by interviews with land owners and residents surrounding the streams. The second factor considered came from the information recorded by survey teams and the last factor considered were field observations of indications of human use at survey sites. The general level of public access was determined primarily by survey team's responses to "Describe Access Opportunities" for each survey site and secondarily on "Bank Access", "Surrounding Conditions that Impede Recreation", and the number of recreation areas located on each stream

Results

Summary of the Informational Meetings

Informational meetings were carried out to present information to the public about TCEQ's RUAA Program, answer questions about RUAAs and our work on specific project streams and talk to local residents and stakeholders about their knowledge and use of these streams. Joe Martin from the Water Quality Standards Group at the TCEQ and John Baker from TAMU presented power point presentations describing TCEQ's RUAA program. Technicians from TAMU interviewed landowners and stakeholders during each meeting.

The informational meeting for the RUAA being carried out on Ayish Bayou was held at the BBVA Compass Bank Conference Room (123 S. Harrison St., San Augustine, TX 75972) on Wednesday, June 25, 2014 at 6:00 pm. To advertise for this meeting, 36 flyers were posted in public areas and municipal buildings around the streams on June 13. Public announcements were placed in the San Augustine Tribune on June 12 and 19 and in the Toledo Chronicle (paper and website) and Shelby County Today (website). Lastly, 98 letters describing the RUAA and advertising the meeting were sent to landowners on the stream. Six stakeholders participated in this meeting.

The informational meeting for the RUAA being carried out on the East Fork of the Angelina River was held at the Mount Enterprise Community Center (308 NW 2nd St., Mount Enterprise, TX 75681) on Thursday, June 26, 2014 at 6:00 pm. To advertise for this meeting, 17 flyers were posted in public areas and municipal buildings around the streams on June 13. Public announcements were placed in the Henderson Daily News (June 15, 17 and 22), Rusk County News (June 18), Daily Sentinel in Nacogdoches, Texas (June 15, 18 and 22). Lastly, 62 letters describing the RUAA and advertising the meeting were sent to landowners on the stream. Seven stakeholders participated in this meeting.

The informational meeting for the RUAAs being carried out on Biloxi Creek, Jack Creek and Paper Mill Creek was held at the Angelina County Extension Office Conference Room (2201 S. Medford Dr., Lufkin, TX 75901) on Tuesday, June 24, 2014 at 6:00 pm. To advertise for this

meeting, 47 flyers were posted in public areas and municipal buildings around the streams on June 12 and 13. Public announcements were placed in the Lufkin Daily News on June 15, 18 and 22. Lastly, 135 letters describing the RUAA and advertising the meeting were sent to landowners on the stream. Eleven stakeholders participated in this meeting.

General Stream Characteristics

Forests were the most frequently recorded riparian zones on all RUAA streams ranging from 63 (Ayish Bayou) to 77 percent (Biloxi Creek) of the sum of the left and right bank riparian zone corridor categorical observations (Table 2). The dominance of forests was followed by pasture which ranged from 16 (Ayish Bayou) to 9 percent (Jack and Paper Mill Creek). Overall mowed maintained corridor was the third most dominant riparian zone followed by marsh and denuded eroded banks.

Six hydrological stream measurements, including continuous and categorical hydrological field observations, were collected during the RUAA to provide a measure of the amount of water in each stream at the time of survey and the stream's potential for recreation (Table 3). All measurements were collected in periods that had a mid-range Palmer drought index. Ayish Bayou had an average thalweg of 0.74 m and an average width of 6.62 m. Field technicians characterized the flow frequency as normal during all surveys and stream type as perennial (52%), intermittent with perennial pools (43%) and intermittent (5%). The channel frequency was characterized as wadeable at all survey sites. Twenty three substantial pools were found at 21 survey sites on Ayish Bayou. The East Fork of the Angelina River had an average thalweg of 0.78 m and an average width of 7.1 m. The flow frequency was characterized as normal during 85% of the surveys and the stream type as perennial (85%), and intermittent with perennial pools (15%). The channel frequency was characterized as wadeable at all survey sites. Seven substantial pools were found. Biloxi, Jack and Paper Mill Creek had average thalwegs of 0.50, 0.49 and 0.57 m, respectively, and average widths that ranged from 4.27 to 4.63 m. Overall, these streams were generally wadeable with a normal flow frequency. Both Jack and Paper Mill Creek were generally characterized as perennial whereas Biloxi Creek was characterized as

intermittent (53%), perennial (33 %) and intermittent with perennial pools (13%). Biloxi, Jack and Paper Mill Creek had 4, 5 and 3 substantial pools, respectively.

Based on the TCEQ Wastewater Outfall shapefile, Ayish Bayou has 1 domestic sewage outfall less than 1 MGD just south of San Augustine (Appendix 1). Jack Creek also has 1 domestic sewage outfall less than 1 MGD in the vicinity of Hudson. No domestic wastewater treatment outfalls were found on the East Fork of the Angelina River, Biloxi Creek or Paper Mill Creek.

The RUAA summary for each stream (Appendix 5) is presented in Table 4. Primary contact, secondary contact 1, secondary contact 2 and non-contact recreation were characterized as occurring frequently on Ayish Bayou, the East Fork of the Angelina River, Biloxi Creek and Jack Creek. Primary contact and secondary contact 1 activities were characterized as occurring seldom on Paper Mill Creek although secondary contact 2 and non-contact frequency were characterized as occurring frequently on this stream. This characterization of Paper Mill Creek was related to very limited public access for secondary contact 1 and secondary contact 2 activities although interviews did indicate primary contact at the confluence of Paper Mill Creek and the Angelina River. Gen public access for Ayish Bayou, the East Fork of the Angelina River, Biloxi Creek and Jack Creek was characterized as moderate

Table 2. Sum of the left bank and right bank riparian zone corridor categorical observations with the percentage of the dominant riparian zone categories calculated for each stream.

Stream	Sum forest	% forest	Sum pasture	% pasture	Sum mowed maintained corridor	% mowed maintained corridor	Sum marsh	% marsh	Sum denuded eroded bank	% denuded eroded bank
Ayish Bayou	42	63	11	16	6	9	2	3	4	6
East Fork Angelina River	26	74	4	11	1	3	1	3	1	3
Biloxi Creek	30	77	6	15	2	5				
Jack Creek	16	73	2	9	2	9	2	9		
Paper Mill Creek	8	73	1	9					2	18

Table 3. Hydrological stream characteristics. Proportional frequencies represent the number of times a condition was recorded at a stream over the number of sites surveyed per stream.

Stream	Avg. thalweg (m)	Avg. width (m)	Subst. pools	Flow category	Freq.	Stream type category	Freq.	Channel category	Freq.	Palmer drought index (PDI)	Freq.
Ayish Bayou	0.74	6.62	23	No flow	0	Ephemeral	0	Non-wadeable	0	Mid-range	1
				Low	0	Intermittent	0.05	Wadeable	1		
				Normal	1	Intermittent w/ per. pools	0.43				
				High	0	Perennial	0.52				
				Flooded	0						
East Fork Angelina River	0.78	7.1	7	No flow	0	Ephemeral	0	Non-wadeable	0	Mid-range	1
				Low	0.08	Intermittent	0	Wadeable	1		
				Normal	0.85	Intermittent w/ per. pools	0.15				
				High	0.08	Perennial	0.85				
				Flooded	0						
Biloxi Creek	0.50	4.27	4	No flow	0.27	Ephemeral	0	Non-wadeable	0	Mid-range	1
				Low	0	Intermittent	0.53	Wadeable	1		
				Normal	0.67	Intermittent w/ per. pools	0.13				
				High	0.07	Perennial	0.33				
				Flooded	0						
Jack Creek	0.49	4.39	5	No flow	0.22	Ephemeral	0	Non-wadeable	0	Mid-range	1
				Low	0	Intermittent	0.11	Wadeable	1		
				Normal	0.78	Intermittent w/ per. pools	0.22				
				High	0	Perennial	0.67				
				Flooded	0						
Paper Mill Creek	0.57	4.63	3	No flow	0	Ephemeral	0	Non-wadeable	0.25	Mid-range	1
				Low	0	Intermittent	0.25	Wadeable	0.75		
				Normal	0.75	Intermittent w/ per. pools	0				
				High	0	Perennial	0.75				
				Flooded	0.25						

Table 4. RUAA summary for each stream.

Stream Name	Ayish Bayou	East Fork of the Angelina River	Biloxi Creek	Jack Creek	Paper Mill Creek
Waterbody	0610A	0611A	0604M	0604C	0615A
Classified	No	No	No	No	No
Primary Contact	Frequently	Frequently	Frequently	Frequently	Seldom
Sec. Contact Rec. 1	Frequently	Frequently	Frequently	Frequently	Seldom
Sec. Contact Rec. 2	Frequently	Frequently	Frequently	Frequently	Frequently
Non-Contact	Frequently	Frequently	Frequently	Frequently	Frequently
Avg Thalweg (m)	0.74	0.78	0.50	0.49	0.60
Subst pools > 1m	Yes	Yes	Yes	Yes	Yes
Gen Public Access	Moderate	Moderate	Moderate	Moderate	Very Limited
Palmer Drought Index	Mid-range	Mid-range	Mid-range	Mid-range	Mid-range

Observations and Evidence of Recreational Use

Primary contact recreational activities were only observed on Jack Creek where wading children were observed at survey site 0604C.3 (Figure 7G)) during the field surveys conducted in this 2014 RUAA project. Secondary contact recreational 1 activities were recorded on Biloxi Creek where family dogs were swimming in the stream at survey points 0604M.4 and 0604M.5 (Figure 9H). Other recreational activities observed during field surveys include the use of an ATV next to Biloxi Creek at survey point 0604M.5, hunting next to Biloxi Creek at survey point 0604M.10 and the use of an ATV next to Jack Creek at survey point 0604C.3.

Six indications of human use (IHU) related to primary contact recreation activities were recorded on four out of the five project streams (Table 5). Two rope swings were found on the East Fork of the Angelina River at survey sites 0611A.5 and 0611A.13 (Figures 7A and 7B). A tree vine used similar to a rope swing (vine swing) was photographed on Biloxi Creek (0604M.3) and is currently being used by children based on an interview conducted with the property owner (Figure 7C). A swimming aid and an inner tube were found on Ayish Bayou at survey sites 0610A.21 and 0610A.22 (Figures 7D and 7E), respectively. An inner tube was also found on Jack Creek at survey site 0604C.11 (Figure 7F).

Young children's toys and various balls were found in three out of the five project streams. Young children's toys were found at survey sites 0604M.7 and 0604M.12 in Biloxi Creek and 0604C.4 in Jack Creek (Table 5, Figures 8E, 8F and 8H). A volleyball was found in both Ayish Bayou and Jack Creek at survey sites 0610A.16 and 0604C.3 (Figures 8A and 8G), respectively. A tennis and soccer ball were found in Biloxi Creek at survey sites 0604M.3 and 0604M.4 (Figure 8C and 8D), respectively. A soft ball was found at survey site 0610A.2 in Ayish Bayou (Figure 8B).

Sixteen IHUs related secondary contact 1 recreation activities involving fishing and boating were found in three of the project streams at multiple survey sites (Table 5). Eight articles of fishing tackle were found at seven survey sites in Ayish Bayou (Figure 9A-D). Four articles of fishing tackle were found at four survey sites in the East Fork of the Angelina River. One article of fishing tackle was found in Biloxi Creek. Two boats were found on the bank of Ayish Bayou at

survey sites 0610A.11 and 0610A.24 (Figure 9E and 9F). One half buried boat was found at survey site 0604M.13 in the channel of Biloxi Creek (Figure 9G).

IHUs relating to hunting and outdoor recreation were found on all five project streams (Table 6). Shotgun shells (3 survey sites), hog heads placed on fence posts, a chair on the bank, a fire pit and a camping site were found on Ayish Bayou. Evidence of target practice (a metal can with bullet holes), shotgun shells and a hunting stand at two different survey sites were found on the East Fork of the Angelina River. Shotgun shells (3 survey sites), a hunting blind, a deer stand, a deer feeder with a wildlife camera and graffiti on a bridge were found along Biloxi Creek. One hunting blind was found along Jack Creek and two were found along Paper Mill Creek.

IHUs found during field surveys related to access are presented in Table 7. Foot prints, foot paths (2), stepping stones, a maintained trail, RV/ATV tracks (6), an ATV bridge and a road going to the stream were found on Ayish Bayou. Foot prints, a foot path and RV/ATV tracks at 6 survey sites were found along the East Fork of the Angelina River. RV/ATV tracks at two survey sites and vehicle tracks were recorded along Biloxi Creek. Shoes on the bank, a foot path and RV/ATV tracks at five survey sites were found on Jack Creek. Lastly, a trail, one set of RV/ATV tracks, and a road going to the stream were recorded along Paper Mill Creek.

Table 5. Indications of Human Use (IHU) recorded during field surveys related to primary contact and secondary contact 1 activities. The presence/absence of each IHU was recorded at each survey site. Values represent the sum of these records for each stream.

		Ayish Bayou	East Fork of the Angelina River	Biloxi Creek	Jack Creek	Paper Mill Creek
IHU related to primary contact						
Rope swings (0611A.5 & 0611A.13)			2			
Vine swing currently used by children (0604M.3)				1		
Inner tube/Swimming aid (0610A.21, 0610A.22 & 0604C.11)		2			1	
	Subtotal	**2**	**2**	**1**	**1**	**0**
IHU related to toys of adolescents found in project streams						
Young children's toys (0604M.7, 0604M.12 & 0604C.4)				2	1	
Volleyball (0610A.16 & 0604C.3)		1			1	
Soccer ball (0604M.4)				1		
Tennis ball (0604M.3)				1		
Soft ball (0610A.2)		1				
	Subtotal	**2**	**0**	**4**	**2**	**0**
IHU related to secondary contact I						
Fishing tackle		8	4	1		
Boat (0610A.11, 0610A.24 & 0604M.13)		2		1		
	Subtotal	**10**	**4**	**2**	**0**	**0**
	Total	**14**	**6**	**7**	**3**	**0**

Figure 7. Photographs of primary contact activities and indications of primary contact recreation activities. A-C) Rope/Vine swings on the East Fork of the Angelina River (A&B) and Biloxi Creek (C). D-F) Inner tube/Swimming aids on Ayish Bayou (D&E) and Jack Creek (F). G) Children wading on Jack Creek.

Figure 8. Photographs of indications of kids' play in project streams. A-B) Volleyball and soft ball found in Ayish Bayou. C-D) Tennis and soccer ball found in Biloxi Creek. E-F) Children's toys found in Biloxi Creek at survey sites 0604M.7 and 0604M.12, respectively. G-H) Volleyball and child's toy found in Jack Creek. at survey sites 0604C.3 and 0604C.4, respectively.

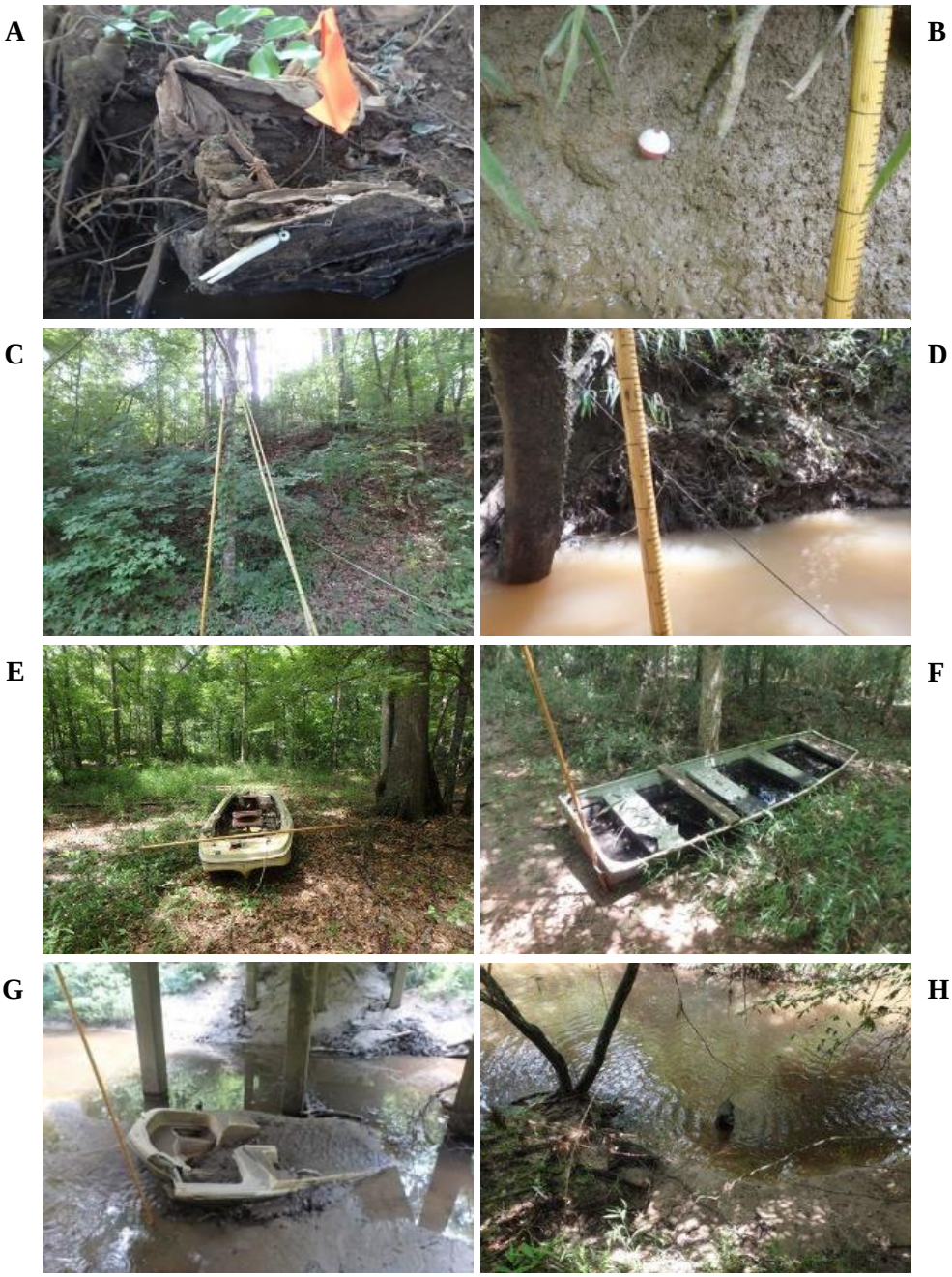

Figure 9. Photographs of indications of secondary contact 1 recreation activities. A-D) Fishing lure, fishing bobber, cane poles, and a drop line, respectively, on Ayish Bayou. E-G) Two boats on Ayish Bayou (E&F) and one boat on Biloxi Creek (G). H) Family dog playing in Biloxi Creek.

Table 6. Indications of human use (IHU) recorded during field surveys related to hunting and outdoor recreation. The presence/absence of each IHU was recorded at each survey site. Values represent the sum of these records for each stream.

		Ayish Bayou	East Fork of the Angelina River	Biloxi Creek	Jack Creek	Paper Mill Creek
IHU related to hunting						
Can with bullet holes			1			
3 hog heads on fence posts		1				
Shotgun shells		3	1	3		
Hunting blind			2	1	1	2
Deer stand				1		
Corn feeder/wildlife camera				1		
	Subtotal	**4**	**4**	**6**	**1**	**2**
IHU related to outdoor recreation						
Graffiti				1		
Chair on the bank (0610A.21)		1				
Fire pit/camping site (0610A.4 & 0610A.22)		2				
	Subtotal	**3**	**0**	**1**	**0**	**0**
	Total	**7**	**4**	**7**	**1**	**2**

Table 7. Indications of human use (IHU) recorded during field surveys related to access to the stream. The presence/absence of each IHU was recorded at each survey site. Values represent the sum of these records for each stream.

	Ayish Bayou	East Fork of the Angelina River	Biloxi Creek	Jack Creek	Paper Mill Creek
IHU related to access					
Clean shoes placed along bank				1	
Foot prints	1	1			
Foot path	2	1		1	
Stepping stones	1				
Trail					1
Maintained trail	1				
RV/ATV tracks	6	6	2	5	1
Vehicle tracks			1		
ATV Bridge	1				
Road	1				1
Total	**13**	**8**	**3**	**7**	**3**

Surrounding Conditions that Promote and Impede Recreation

Surrounding conditions that promote recreation were found on all project streams. As already mentioned two rope swings on the East Fork of the Angelina River and a vine swing on Biloxi Creek were the only surrounding conditions that specifically promoted primary contact recreation (Table 8). Overall, wildlife (29 survey sites) was recorded as the most frequent surrounding condition that promotes recreation followed by bridge crossings (17), natural surroundings (17), trails (11), public property (3), beach/sand bar (3), roads (3), power line corridors (2) and a pavilion, walkway and cleared bank. Surrounding conditions that promoted all types of recreation on Ayish Bayou included a walkway (Figure 10B), trails or paths, public property (Figure 10A), wildlife, natural surroundings (Figure 10G), a cleared bank, bridge crossings (Figure 10E), parking lots, roads and a power line corridor. On the East Fork of the Angelina River trails, wildlife, natural surroundings, bridge crossings and a parking lot were recorded. Surrounding conditions that promoted recreation on Biloxi Creek included a pavilion with a barbeque pit (Figure 10C), a trail, wildlife (Figure 10H), natural surroundings and 3 bridge crossings (Figure 10D). Beaches or sand bars, trails (Figure 10F), wildlife, natural surroundings and bridge crossings were recorded on Jack Creek. Surrounding conditions that promoted all types of recreation on Paper Mill Creek included wildlife, a road and a power line corridor.

Surrounding conditions that impede recreation were found on all project streams (Table 9). Overall, private property (43 survey sites) was recorded as the most frequent impediment of recreation on all streams followed by fences (21, Figure 11B) and steep slopes (21), log jams or fallen logs (18, Figure 11C), potentially dangerous wildlife (13, Figure 11D), thick vegetation (11), garbage/flood debris (9, Figure 11G), very little water (7), no trespassing signs (5), remote locations (2), lack of roads (1) and water quality (1, Figures 11E-G) . On Ayish Bayou, no public access/private property (14) was the most frequent surrounding condition to impede recreation followed by fences (9), steep slopes (8), potentially dangerous wildlife (5), debris (5, Figure 11G), log jams (4), no trespassing signs (3, Figure 11A), remote locations (1), the absence of roads (1) and very little water (1). During field surveys on Ayish Bayou, thirteen log jams total were recorded as obstructing the stream channel (Table 10). Log jams (9) were the most frequently recorded surrounding condition to impede recreation on the East Fork of the Angelina

River followed by no access/private property (8), fences (5), thick vegetation (3), dangerous wildlife (2) and steep slopes (2). Thirteen log jams and one low bridge were recorded to obstruct the stream channel on the East Fork of the Angelina River. On Biloxi Creek, no public access/private property (11) was most frequently recorded condition to impede recreation followed by steep slopes (5), fences (4), log jams (4), very little water (4), debris (3), thick vegetation (2), dangerous wildlife (2), no trespassing signs (1) and remote locations (1). Fourteen log jams, barbed wire, garbage, rip rap, a fence and a low bridge were recorded as channel obstructions on Biloxi Creek by field technicians. No public access/private property (8) was the most frequent impediment on Jack Creek followed by steep slopes (4), thick vegetation (3), dangerous wildlife (3), fences (2), very little water (2) and water quality (1, Figure 11E). Log jams (7), thick vegetation (2), rip rap (1) and barbed wire (1) were recorded as channel obstructions on Jack Creek. Surrounding conditions that impede recreation on Paper Mill Creek include no public access/private property (2), steep slopes (2), a fence, a no trespass sign, thick vegetation, a log jam, dangerous wildlife (1) and debris (1). In addition, Paper Mill Creek had 3 log jams and one record of rip rap obstructing the stream channel.

Table 8. Surrounding conditions (SC) that promote primary contact recreation and other types of recreation recorded during field surveys for each stream. The presence/absence of each SC was recorded at each survey site. Values represent the sum of these records for each stream.

		Ayish Bayou	East Fork of the Angelina River	Biloxi Creek	Jack Creek	Paper Mill Creek
Surrounding conditions that promote primary contact recreation						
Rope swing (0611A.5)			1			
Access area with a rope swing (0611A.13)			1			
Tree vine used as a rope swing by children (0604M.3)				1		
	Subtotal	**0**	**2**	**1**	**0**	**0**
Surrounding conditions that promote all types of recreation						
Pavilion with bbq pit				1		
Stairs/walkway		1				
Trails/paths (hiking/biking/ATV)		6	2	1	2	
Public property/park/managed land		3				
Wildlife		9	6	7	6	1
Natural surroundings/corridor		9	4	2	2	
Beach/sand bar (0604C.3, 0604C.4 & 0604C.7)					3	
Cleared banks		1				
Bridge crossing		9	2	3	3	
Paved/unpaved parking lot		2	1			
Roads (paved/unpaved)		2				1
Power line corridor		1				1
	Subtotal	**43**	**15**	**14**	**16**	**3**
	Total	**43**	**17**	**15**	**16**	**3**

Figure 10. Factors that promote recreation on project streams. A-B) A public park with a boardwalk on Ayish Bayou in San Augustine, Texas. C-D) A pavilion with a barbeque pit and a small bridge crossing the stream at survey site 0604M.1 on Biloxi Creek. E) Bridge crossing on Ayish Bayou. F) Maintained trail leading up to Jack Creek. G) Beautiful natural scenery on a project stream. H) The presence of wildlife for recreational activities such as wildlife watching or hunting.

Table 9. Characteristics that impede recreation recorded during field surveys for each stream.

	Ayish Bayou	East Fork of the Angelina River	Biloxi Creek	Jack Creek	Paper Mill Creek
Factors that impede access and recreation					
Fence	9	5	4	2	1
No trespass sign/private property sign	3		1		1
No public access/private property	14	8	11	8	2
Remote area (0610A.24 & 0604M.12)	1		1		
No roads (0610A.18)	1				
Thick vegetation		3	2	3	1
Log jams and fallen logs	4	9	4		1
Potentially dangerous wildlife	5	2	2	3	1
Steep slopes	8	2	5	4	2
Very little water, no flow or no water	1		4	2	
Water quality				1	
Garbage and flood debris	5		3		1
Total	**51**	**29**	**37**	**23**	**10**

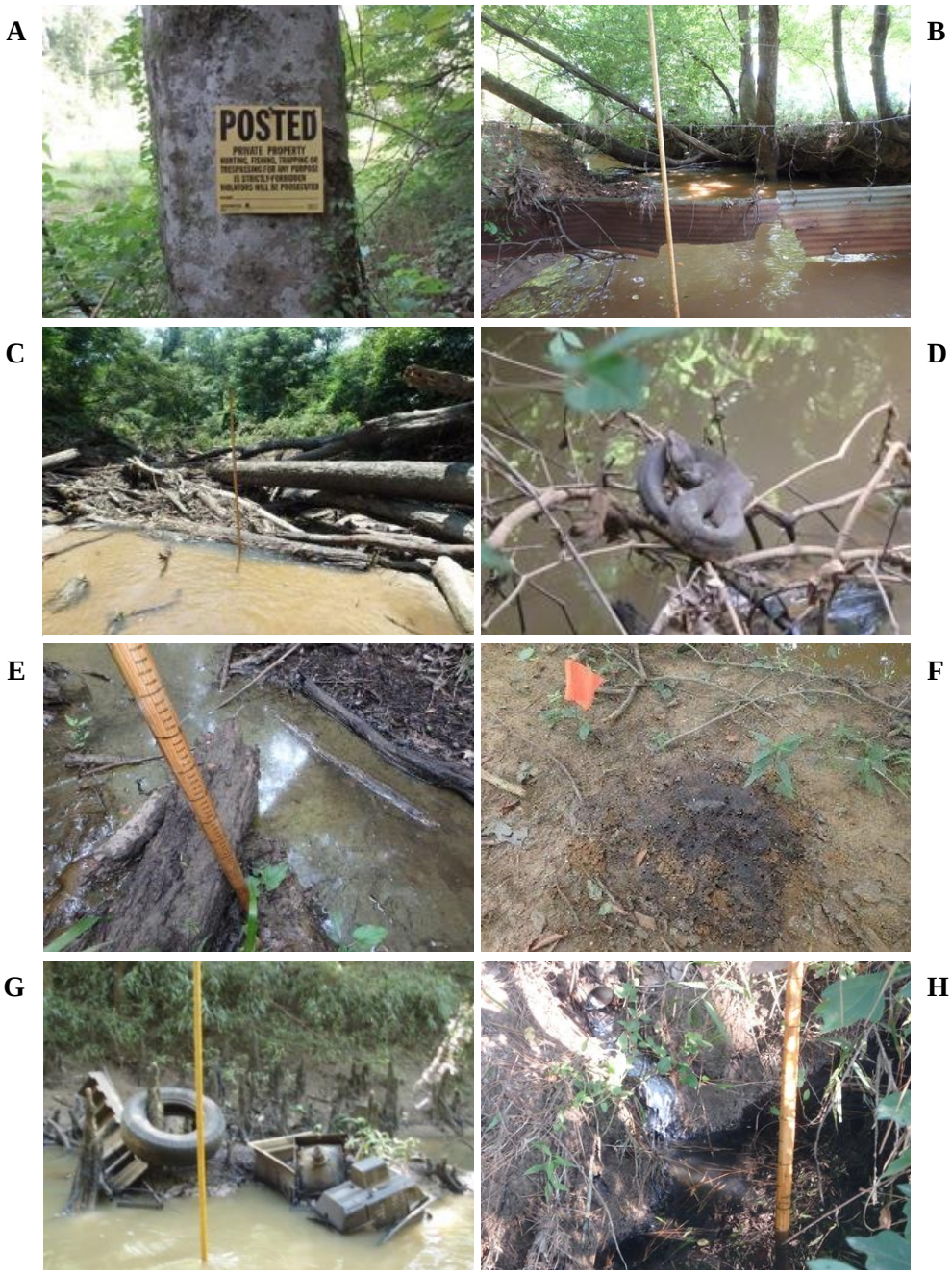

Figure 11. Factors that impede recreation on project streams. A) No trespassing sign. B) Fence crossing the stream reducing accessibility. C) Log jam reducing accessibility. D) Dangerous wildlife. E) Photograph of poor water quality (stagnant and foul smelling) at survey site 0604C.9 on Jack Creek. F) Cow manure next to the stream at survey site 0610A.3 on Ayish Bayou. G) Garbage dumped into the stream on Ayish Bayou at survey site 0610A.21. H) Flowing point source at survey site 0604M.1 on Biloxi Creek.

Table 10. Channel obstructions recorded during field surveys for each stream.

	Ayish Bayou	East Fork of the Angelina River	Biloxi Creek	Jack Creek	Paper Mill Creek
Barbed wire (0604M.1 & 0604C.2)			1	1	
Fences (0604M.2)			1		
Garbage (0604M.5)			1		
Rip rap (0604M.5, 0604C.3 & 0615A.3)			1	1	1
Thick vegetation (0604C.9 & 0604C.10)				2	
Log jams	13	13	14	7	3
Low bridge (0611A.17 & 0604M.2)		1	1		
Total	**13**	**14**	**19**	**11**	**4**

Recreational Use Interviews

Unclassified water body 0610A (Ayish Bayou):

Seventy recreational use interviews were conducted in the Ayish Bayou area. Most of the interviews were conducted in person (94%) by two field technicians, while six percent of the interviews were conducted over the phone by one technician. The majority of the interviewees were selected because they live near the stream (61%). Other interviewees were selected because the stream flows through their property (16%), their house is adjacent to the stream (4%), they are a local stakeholder (4%), they were fishing in the stream (3%), they are a local government official (3%) or they work in the area (1%) (Figure 12).

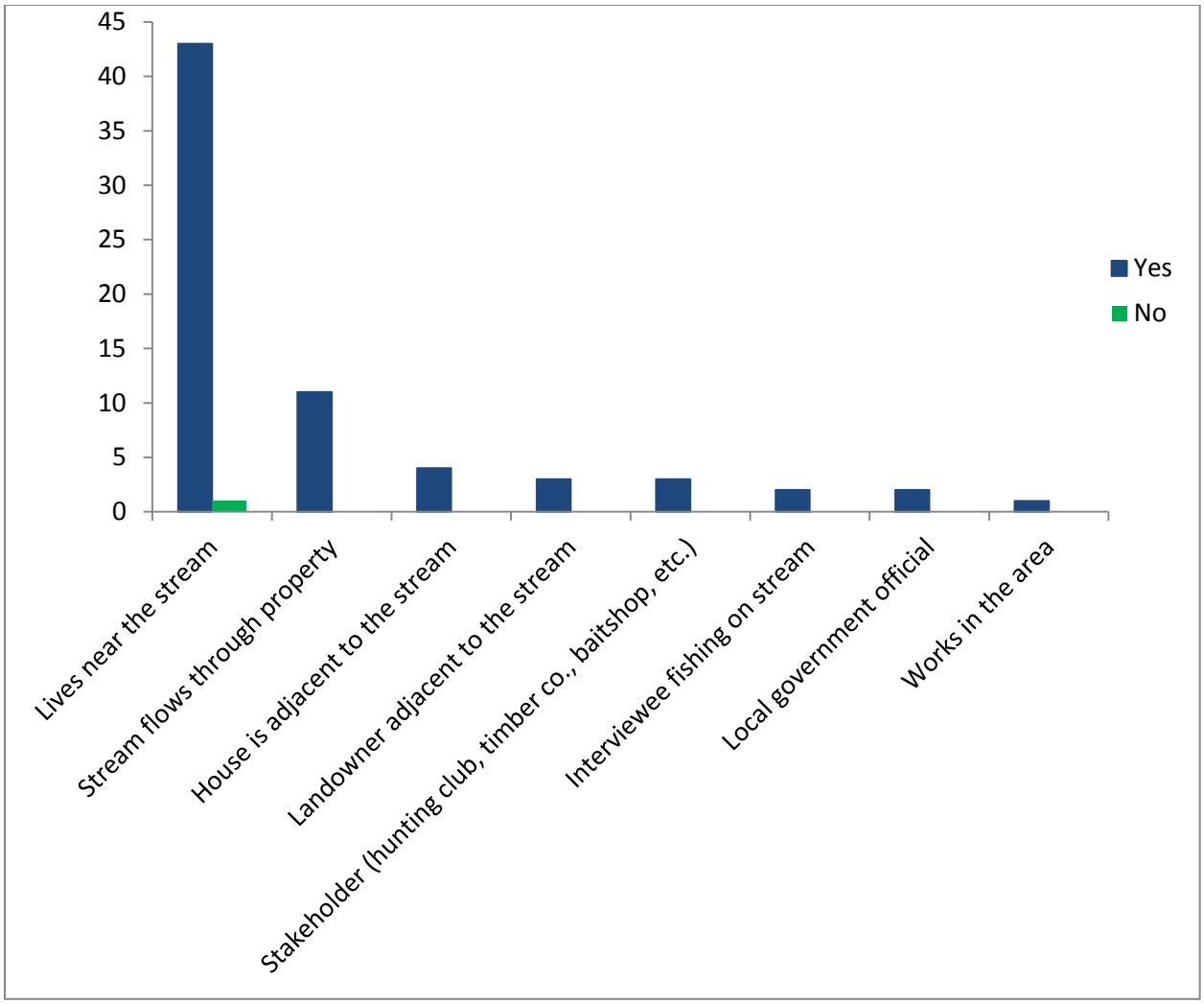

Figure 12. Number of interviewees that participated in interviews assessing recreation in Ayish Bayou (Water body 0610A). Categories represent the reason why interviewees were selected. Yes/No indicates whether interviews were completed.

The majority of people that were interviewed have been familiar with the water body for over 50 years (33%). Eighty percent of the 70 interviewees have been familiar with the stream for over 10 years (Figure 11). Fifty nine percent of the interviewees classified the stream as perennial and another 20% classified Ayish Bayou as being intermittent with perennial pools (Table 12).

Table 11. Number of years interviewees have been familiar with Ayish Bayou (Water body 0610A).

No. of years familiar	Percentage of interviews
≤5	12%
5-<10	3%
10-<20	17%
20-<50	30%
≥50	33%
Unknown/No data	5%

Table 12. Stream classification by interviewees which are familiar with portions of Ayish Bayou (Water body 0610A).

Classification	Percentage of interviewees
Perennial	59%
Intermittent w/ perennial pools	20%
Intermittent	20%
Ephemeral	0%
No data	2%

More than half of the people that participated in the interviews and their families use Ayish Bayou for recreation (53%). Among the interviewees that use the stream for recreation, 8% engage in primary contact recreational activities, while 68% engage in secondary contact 1 recreational activities. Primary contact recreational activities include swimming (3 interviews) and wading children (3 interviews) (Table 13). Secondary contact recreational activities include wading adults, fishing, kayaking, boating, and a family dog that goes into the stream.

Based on 24 interviews in which data was obtained on the number of days per year recreation occurs in Ayish Bayou, 71% of the interviewees and their families recreate in Ayish Bayou between 1 to 30 days per year (Average = 17 ± 8 days/year) and 29% use the stream between 30 to 180 days per year (Average = 80 ± 40 days/year). On average, interviewees and their families who carry out primary contact activities use the stream 40 ± 17 days per year (Based on 3 interviews). Recreation in Ayish Bayou occurs in all seasons.

Table 13. Recreational activities reported in Ayish Bayou (Water body 0610A) that involve the person that was interviewed and or his/her family. Note that a single interviewee can report one or more recreational activities.

Personal or family uses	Number of reports
Primary contact recreational activities	
Swimming	3
Wading - Children	3
Secondary contact recreational activities	
Wading - Adults	1
Fishing (For consumption)	13
Fishing (Catch and release)	5
General fishing	11
Kayaking	1
Boating	2
Walking a dog that goes into the stream	1
Noncontact recreational activities	
ATV riding	2
Camping	5
Hunting	12
Picnicking	2
Playing on shore or banks	4
Riding horses	1
Watching wildlife or nature	2
No recreational activities	
Do not use	32

Most of the interviewees that do not use the stream for recreation have other personal interests (34%). Other reasons given for not using the stream were related to difficult access (11%), preferring to recreate in the lake or other water bodies (9%), poor access (9%), poor water quality (9%) as well as low water levels (9%) (Table 14).

Table 14. Reasons stated by interviewees for not using Ayish Bayou (Water body 0610A). Note that a single interviewee can report one or more reasons for not using the stream for recreation.

Reasons for not using the stream	Percentage of interviews
Interviewee has other personal interests	34%
Interviewee prefers the lake or other water bodies	9%
Interviewee does not live in the area	4%
Generally poor access	9%
Access is difficult (fallen trees, log jams, forest or distance)	11%
Poor access due to private property.	5%
Potentially dangerous wildlife (snakes or alligators) or quicksand	7%
Used specifically for cattle	2%
Trash	2%
Poor water quality	9%
Low water levels	9%

Interviewees have witnessed a variety of recreational activities currently occurring in Ayish Bayou (Table 15). These activities included primary contact recreation (2 reports of swimming and 1 report of hand fishing or noodling) and secondary contact recreation including multiple types of fishing and boating. Fishing was the most frequently witnessed activity. Noncontact recreational activities witnessed included camping and hunting. Forty four percent of interviewees have not witnessed recreation in Ayish Bayou.

Table 15. Recreational activities in Ayish Bayou (Water body 0610A) witnessed by interviewees. Note that a single interviewee may report witnessing one or more recreational activities.

Witnessed Recreational Activities	Number of reports
Primary contact recreational activities	
Swimming	2
Hand fishing (Noodling)	1
Secondary contact recreational activities	
Fishing (For consumption)	15
Fishing (Catch and release)	7
General fishing	15
Fishing competition	1
Boating	1
Noncontact recreational activities	
Camping	3
Hunting	11

Interviewees also reported hearing of a variety of recreational activities occurring in Ayish Bayou (Table 16). These activities included 2 reports of primary contact recreation (swimming) and secondary contact recreation including 24 reports of fishing and 1 report of boating. Fishing was the most frequent recreational activity that people have heard of occurring in the stream. Noncontact recreational activities heard of include camping, hunting and watching wildlife. Sixty four percent of interviewees have not heard of recreation occurring in Ayish Bayou.

Table 16. Recreational activities that interviewees have heard of occurring in Ayish Bayou (Water body 0610A). Note that a single interviewee can report hearing of one or more recreational activities.

Recreational activities heard of occurring along the stream	Number of reports
Primary contact recreational activities	
Swimming	2
Secondary contact recreational activities	
Fishing (For consumption)	9
Fishing (Catch and release)	5
General fishing	10
Boating	1
Noncontact recreational activities	
Camping	4
Hunting	7
Watching wildlife or nature	1

Unclassified water body 0611A (East Fork of the Angelina River):

Sixty two recreational use interviews were conducted in the East Fork of the Angelina River area. Most of the interviews were conducted in person (97%) by two field technicians, while two interviews (3%) were conducted over the phone by one technician.

The majority of the interviewees were selected because they live near the stream (65%). Other interviewees were selected because the stream flows through their property (16%), they are a landowner adjacent to the stream (5%), they are a landowner near the stream (3%), their house is adjacent to the stream (1.6%), they were fishing in the stream (1.6%), they kayak on the stream (1.6%), they are a manager of a property containing the stream (1.6%) or they are a local stream stakeholder (1.6%) (Figure 13).

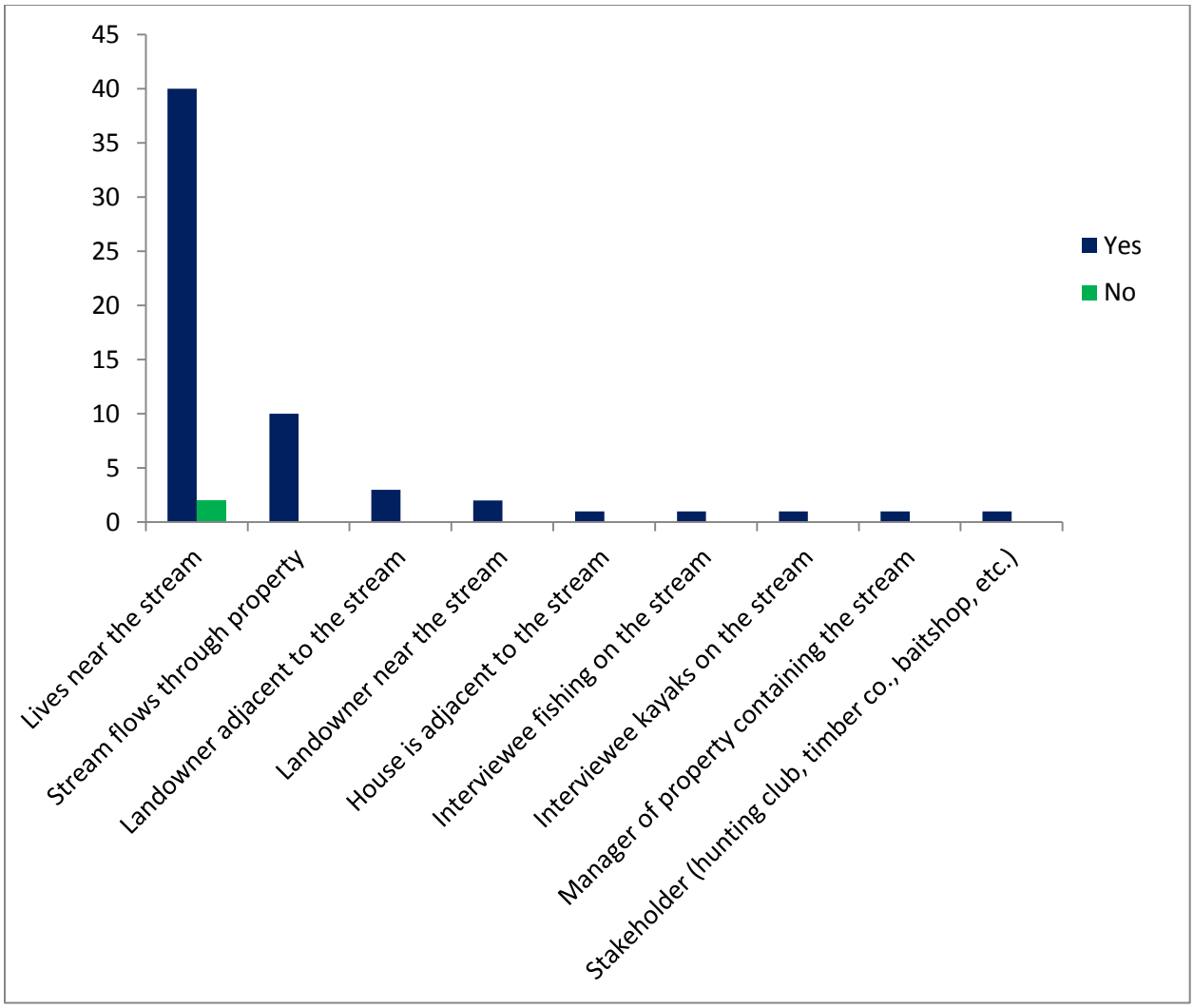

Figure 13. Number of interviewees that participated in interviews assessing recreation in the East Fork of the Angelina River (Water body 0611A). Categories represent the reason why interviewees were selected. Yes/No indicates whether interviews were completed.

The majority of people that were interviewed have been familiar with the water body for 50 or more years (33%) (Table 17). Most interviewees classified the stream as perennial (72%) or intermittent with perennial pools (16%) (Table 18).

Table 17. Number of years interviewees have been familiar with East Fork of the Angelina River (Water body 0611A).

No. of years familiar	Percentage of interviews
≤5	17%
5-<10	10%
10-<20	8%
20-<50	29%
≥50	33%
Unknown/No data	4%

Table 18. Stream classification by interviewees which are familiar with portions of East Fork of the Angelina River (Water body 0611A).

Classification	Percentage of interviewees
Perennial	72%
Intermittent w/ perennial pools	16%
Intermittent	12%
Ephemeral	0%

Forty two percent of the people that participated in the interviews and their families use the East Fork of the Angelina River for recreation. Among the interviewees that use the stream for recreation, 23% engage in primary contact recreational activities, while 77% engage in secondary contact 1 recreational activities. Primary contact recreational activities include swimming (6 interviews) (Table 19). Secondary contact recreational activities include fishing, kayaking and boating.

Based on 19 interviews in which data was obtained on the number of days per year recreation occurs in the East Fork of the Angelina River, 42% of the interviewees and their families recreate in the East Fork of the Angelina River between 1 to 30 days per year (Average = 12 ± 9 days/year) and 58% use the stream between 30 to 180 days per year (Average = 69 ± 38 days/year). On average, interviewees and their families who carry out primary contact activities use the stream 42 ± 34 days per year (Based on 7 interviews). Recreation in the East Fork of the Angelina River occurs in all seasons.

Table 19. Recreational activities reported in the East Fork of the Angelina River (Water body 0611A) that involve the person that was interviewed and or his/her family. Note that a single interviewee can report one or more recreational activities.

Personal or family uses	Number of reports
Primary contact recreational activities	
Swimming	6
Secondary contact recreational activities	
Fishing (For consumption)	3
Fishing (Catch and release)	6
General fishing	10
Kayaking	1
Boating	1
Noncontact recreational activities	
ATV riding	3
Camping	1
Hunting (Deer, hogs and/or ducks)	12
Playing on shore or banks	1
Watering cattle	2
No recreational activities	
Do not use	33

Most of the interviewees that do not use the stream for recreation have other personal interests (43%). Other reasons given for not using the stream were related to low or no water (16%), potentially dangerous wildlife (14%) as well as not being familiar with the stream (11%) (Table 20).

Table 20. Reasons stated by interviewees for not using the East Fork of the Angelina River (Water body 0611A). Note that a single interviewee can report one or more reason for not using the stream for recreation.

Reasons for not using the stream	Percentage of interviews
Interviewee has other personal interests	43%
Interviewee prefers other water bodies	3%
Interviewee is not familiar with the stream	11%
Poor access	8%
Poor access due to cut down timber or beaver dams	5%
Potentially dangerous wildlife (snakes, hogs or not specified)	14%
Low or no water	16%

Interviewees have witnessed a variety of recreational activities currently occurring in the East Fork of the Angelina River (Table 21). These activities included primary contact recreation (swimming) and secondary contact recreation including wading by adults and fishing. Fishing was the most frequently witnessed activity. Hunting was the only noncontact recreational activity reported. Fifty eight percent of interviewees have not witnessed recreation in the East Fork of the Angelina River.

Table 21. Recreational activities in the East Fork of the Angelina River (Water body 0611A) witnessed by interviewees. Note that a single interviewee may report witnessing one or more recreational activities.

Witnessed Recreational Activities	Number of reports
Primary contact recreational activities	
Swimming	2
Secondary contact recreational activities	
Wading - Adults	1
Fishing (For consumption)	3
Fishing (Catch and release)	7
General fishing	12
Noncontact recreational activities	
Hunting	3

Interviewees also reported hearing of a variety of recreational activities occurring in East Fork of the Angelina River (Table 22). These activities included primary contact recreation (1 report of swimming and 1 report of hand fishing or noodling) and secondary contact recreational activities including wading, fishing and rafting. The most frequent recreational activity that people have heard of occurring in the stream was fishing. Noncontact recreational activities heard of include camping and hunting. Seventy three percent of interviewees have not heard of recreation occurring in the East Fork of the Angelina River.

Table 22. Recreational activities that interviewees have heard of occurring in the East Fork of the Angelina River (Water body 0611A). Note that a single interviewee can report hearing of one or more recreational activities.

Recreational activities heard of occurring along the stream	Number of reports
Primary contact recreational activities	
Swimming	1
Hand fishing (Noodling)	1
Secondary contact recreational activities	
Wading to set trot lines	1
Fishing (For consumption)	1
Fishing (Catch and release)	1
General fishing	5
Rafting (For fishing purposes)	1
Noncontact recreational activities	
Camping	1
Hunting	4

Unclassified water body 0604M (Biloxi Creek):

Thirty one recreational use interviews were conducted in the Biloxi Creek area. Most of the interviews were conducted in person (90%) by two field technicians, while three interviews (10%) were conducted over the phone by one technician. The majority of the interviewees were selected because they live near the stream (42%) or the stream flows through their property (32%). Other interviewees were selected because they are a landowner adjacent to the stream (13%), their house is adjacent to the stream (6%), they are a manager of the property containing the stream (3%) or they are a local stakeholder (3%) (Figure 14).

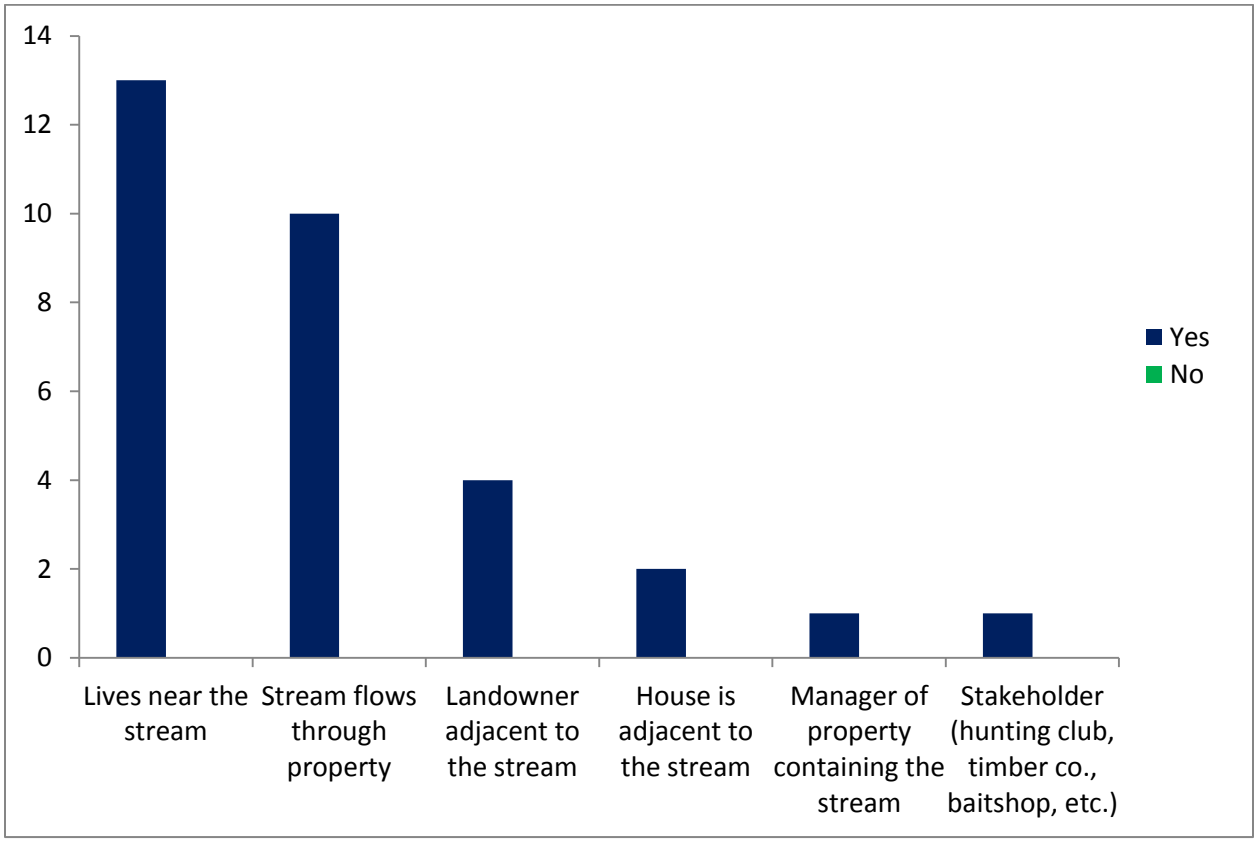

Figure 14. Number of interviewees that participated in interviews assessing recreation in Biloxi Creek (Water body 0604M). Categories represent the reason why interviewees were selected. Yes/No indicates whether interviews were completed.

The majority of people that were interviewed have been familiar with the water body for 20 to 50 years (38%). Thirty five percent of interviewees have been familiar with the stream for more than 50 years (Table 23). Most interviewees classified the stream as intermittent (44%). Thirty two percent of interviewees classified the stream as perennial (Table 24).

Table 23. Number of years interviewees have been familiar with Biloxi Creek (Water body 0604M).

No. of years familiar	Percentage of interviews
≤5	8%
5-<10	4%
10-<20	15%
20-<50	38%
≥50	35%

Table 24. Stream classification by interviewees which are familiar with portions of Biloxi Creek (Water body 0604M).

Classification	Percentage of interviewees
Perennial	32%
Intermittent w/ perennial pools	24%
Intermittent	44%
Ephemeral	0%

Forty two percent of the people that participated in the interviews and their families use Biloxi Creek for recreation. Among the interviewees that use the stream for recreation, 15% engage in primary contact recreational activities, while 38% engage in secondary contact 1 recreational activities. Primary contact recreational activities include swimming (3 interviews) and wading children (2 interviews) (Table 25). Secondary contact recreational activities include fishing and a family dog getting into the stream.

Based on 4 interviews in which data was obtained on the number of days per year recreation occurs in Biloxi Creek, 2 of the interviewees and their families recreate in Biloxi Creek 24 days per year and 2 use the stream for 120 and 300 days per year. One of the above interviewees and their family who use the stream 24 days per year carry out primary contact activities (swimming and wading children). A second interviewee and their family used to swim in the stream 50 days per year about 35 to 45 years ago. Recreation in Biloxi Creek occurs in all seasons.

Table 25. Recreational activities reported in Biloxi Creek (Water body 0604M) that involve the person that was interviewed and or his/her family. Note that a single interviewee can report one or more recreational activities.

Personal or family uses	Number of reports
Primary contact recreational activities	
Swimming	3
Wading - Children	2
Secondary contact recreational activities	
Fishing (For consumption)	1
Fishing (Catch and release)	2
General fishing	1
Dogs get in the stream	1
Noncontact recreational activities	
ATV riding	2
Hunting and shooting	6
Playing on shore or banks	1
Drives in the creek bed	1
Ride horses to survey fence	1
Walking	2
Watching wildlife or nature	1
Watering Cattle	6
No recreational activities	
Do not use	15

Most of the interviewees that do not use the stream for recreation have other personal interests (22%) or think it does have enough water (Low water levels, 22%). Other reasons given for not using the stream were related to poor water quality (14%), interviewee prefers to recreate on other water bodies (8%) and steep banks (8%) (Table 26).

Table 26. Reasons stated by interviewees for not using Biloxi Creek (Water body 0604M). Note that a single interviewee can report one or more reason for not using the stream for recreation.

Reasons for not using the stream	Percentage of interviews
Interviewee has other personal interests	22%
Interviewee prefers other water bodies	8%
Interviewee is not familiar with the stream	6%
Company does not recreate on the stream	3%
Poor access	3%
Lack of access	3%
Potentially dangerous wildlife (snakes)	3%
Steep banks	8%
Poor water quality (A lot of trash/dumping of trash in stream)	14%
Poor water quality	6%
Low water levels	22%
No water or too much water	3%

Interviewees have not witnessed any primary contact recreational activities occurring in Biloxi Creek (Table 27). Secondary contact recreational activities witnessed in Biloxi Creek include wading by adults, fishing and fishing for crawfish. Noncontact recreational activities witnessed include riding ATVs and hiking. Eighty one percent of interviewees have not witnessed recreation in Biloxi Creek.

Table 27. Recreational activities in Biloxi Creek (Water body 0604M) witnessed by interviewees. Note that a single interviewee may report witnessing one or more recreational activities.

Witnessed Recreational Activities	Number of reports
Primary contact recreational activities	
No primary contact recreation witnessed	0
Secondary contact recreational activities	
Wading - Adults	1
Fishing (For consumption)	1
Crawfishing	1
Noncontact recreational activities	
ATV riding	2
Hiking	1

Interviewees did not report hearing of any primary contact recreational activities occurring in Biloxi Creek (Table 28). Secondary contact recreational activities reported being heard of in Biloxi Creek include wading by adults and walking in the stream. Noncontact recreational activities heard of include riding ATVs, picking dewberries and hunting. Seventy four percent of interviewees have not heard of recreation occurring in Biloxi Creek.

Table 28. Recreational activities that interviewees have heard of occurring in Biloxi Creek (Water body 0604M). Note that a single interviewee can report hearing of one or more recreational activities.

Recreational activities heard of occurring along the stream	Number of reports
Primary contact recreational activities	
No primary contact recreation activities were heard of along the stream	0
Secondary contact recreational activities	
Wading - Adults	1
Wading - Adults (to collect arrowheads)	1
Walking stream to look for petrified wood	1
Noncontact recreational activities	
ATV riding	1
Dewberry picking	1
Hunting	4

Unclassified water body 0604C (Jack Creek):

Twenty eight recreational use interviews were conducted in the Jack Creek area. Most of the interviews were conducted in person (89%) by two field technicians, while three interviews (11%) were conducted over the phone by one technician. The majority of the interviewees were selected because the stream flows through their property (64%). Other interviewees were selected because they live near the stream (25%) or their house is adjacent to the stream (Figure 15).

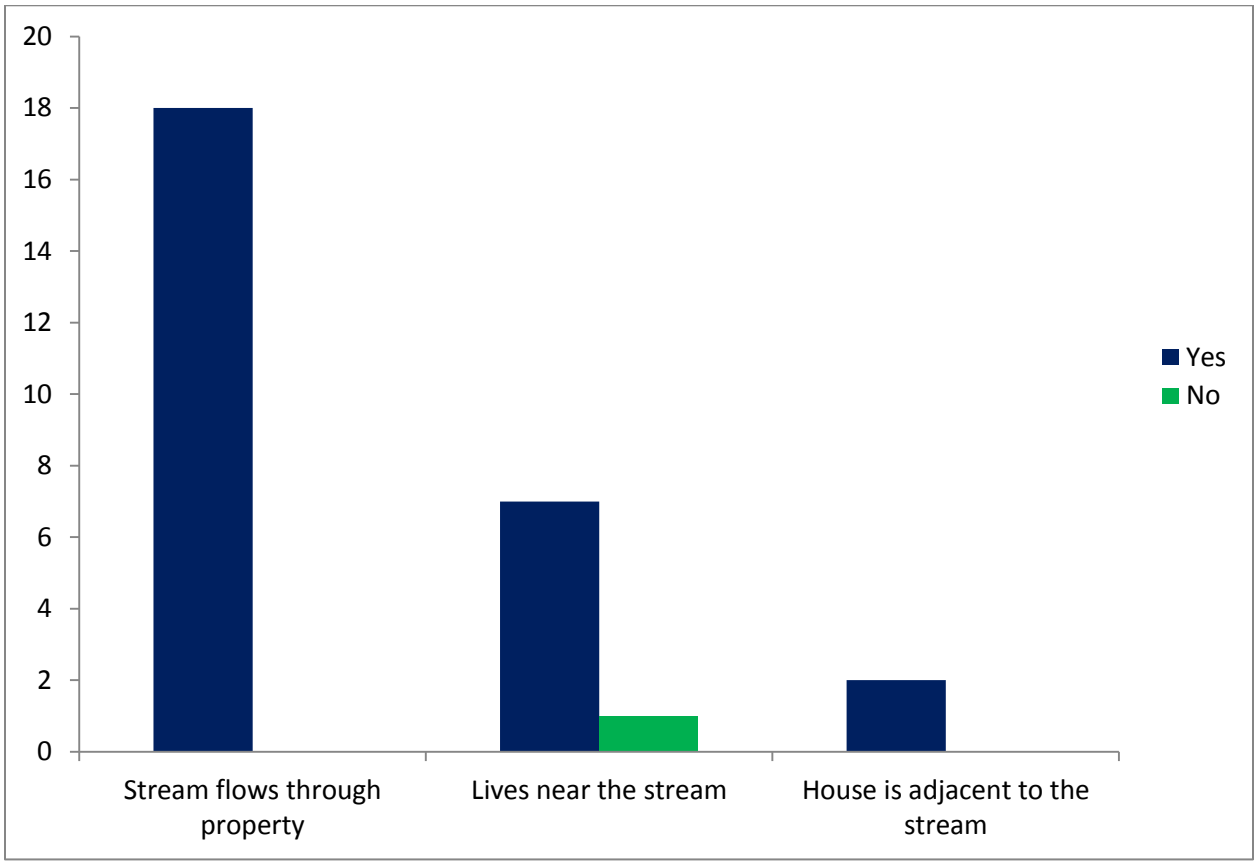

Figure 15. Number of interviewees that participated in interviews assessing recreation in Jack Creek (Water body 0604C). Categories represent the reason why interviewees were selected. Yes/No indicates whether interviews were completed.

The majority of people that were interviewed have been familiar with the water body for 20 to 50 years (48%). Thirteen percent of interviewees have been familiar with Jack Creek for 50 or more years (Table 29). Most interviewees classified the stream as perennial (64%) (Table 30).

Table 29. Number of years interviewees have been familiar with Jack Creek (Water body 0604C).

No. of years familiar	Percentage of interviews
≤5	13%
5-<10	9%
10-<20	17%
20-<50	48%
≥50	13%

Table 30. Stream classification by interviewees which are familiar with portions of Jack Creek (Water body 0604C).

Classification	Percentage of interviewees
Perennial	64%
Intermittent w/ perennial pools	9%
Intermittent	14%
Ephemeral	0%
Did not know/specify	14%

Thirty nine percent of the people that participated in the interviews and their families use Jack Creek for recreation. Among the interviewees that use the stream for recreation, 46% engage in primary contact recreation activities, while 18% engage in secondary contact 1 recreational activities. Primary contact recreational activities include swimming (8 interviews) and wading children (4 interviews) (Table 31). Secondary contact recreational activities include wading adults, fishing and a family dog going into the stream.

Based on 7 interviews in which data was obtained on the number of days per year recreation occurs in Jack Creek, 57% of the interviewees and their families recreate in Jack Creek between 1 to 30 days per year (Average = 23 ± 12 days/year) and 43% use the stream between 30 to 180 days per year (Average = 61 ± 16 days/year). On average, interviewees and their families who carry out primary contact activities use the stream 49 ± 21 days per year (Based on 5 interviews). Recreation in Jack Creek occurs in all seasons.

Table 31. Recreational activities reported in Jack Creek (Water body 0604C) that involve the person that was interviewed and or his/her family. Note that a single interviewee can report one or more recreational activities.

Personal or family uses	Number of reports
Primary contact recreational activities	
Swimming	8
Wading - Children	4
Secondary contact recreational activities	
Wading - Adults	2
General fishing	1
Dog goes in the stream	1
Noncontact recreational activities	
ATV riding	6
Camping	2
Horseback riding	4
Hunting	5
Picnicking	3
Playing on shore or banks	4
Use for scenic views	1
Walking	1
Watching wildlife or nature	1
Watering cattle	2
No recreational activities	
Do not use	15

Most of the interviewees who do not use the stream state that the stream has low or no water (28%). Other reasons given for not using the stream were related to other personal interests (24%), not being familiar with the stream (17%) and poor water quality (14%) (Table 32).

Table 32. Reasons stated by interviewees for not using Jack Creek (Water body 0604C). Note that a single interviewee can report one or more reason for not using the stream for recreation.

Reasons for not using the stream	Percentage of interviews
Interviewee has other personal interests	24%
Interviewee is not familiar with the stream	17%
Poor access due to overgrown vegetation	3%
Poor access due to private property	3%
Potentially dangerous wildlife (snakes)	3%
Used for cattle	3%
Poor water quality	14%
Stream is prone to flooding	3%
Low or no water	28%

Interviewees have witnessed a variety of recreational activities currently occurring in Jack Creek (Table 33). Primary contact recreational activities witnessed included five reports of swimming and wading children. Secondary contact recreational activities witnessed included wading by adults, fishing and fishing for crawfish. Noncontact activities included riding ATVs, camping, horseback riding, hunting, artifact hunting, picnicking and playing on the shore or banks. Fifty seven percent of interviewees have not witnessed recreation in Jack Creek.

Table 33. Recreational activities in Jack Creek (Water body 0604C) witnessed by interviewees. Note that a single interviewee may report witnessing one or more recreational activities.

Witnessed Recreational Activities	Number of reports
Primary contact recreational activities	
Swimming	5
Wading - Children	5
Secondary contact recreational activities	
Wading - Adults	2
General fishing	1
Crawfishing	1
Noncontact recreational activities	
ATV riding	4
Camping	3
Horseback riding	4
Hunting	6
Native American artifact hunting	1
Picnicking	2
Playing on shore or banks	1

Interviewees did not report hearing of any primary or secondary contact recreational activities occurring in Jack Creek (Table 34). Noncontact recreational activities heard of occurring on the stream include hunting and watering cattle. Eighty two percent of interviewees have not heard of recreation occurring in Jack Creek.

Table 34. Recreational activities that interviewees have heard of occurring in Jack Creek (Water body 0604C). Note that a single interviewee can report hearing of one or more recreational activities.

Recreational activities heard of occurring along the stream	Number of reports
Primary contact recreational activities	
No primary contact recreational activities were heard of along the stream	0
Secondary contact recreational activities	
No secondary contact rec. activities were heard of along the stream	
Noncontact recreational activities	
Hunting	3
Watering cattle	1

Unclassified water body 0615A (Paper Mill Creek):

Nine recreational use interviews were conducted in the Paper Mill Creek area. All of the interviews were conducted in person. The interviewees were selected because they live near the stream (87.5%) or are landowners near the stream (12.5%) (Figure 16).

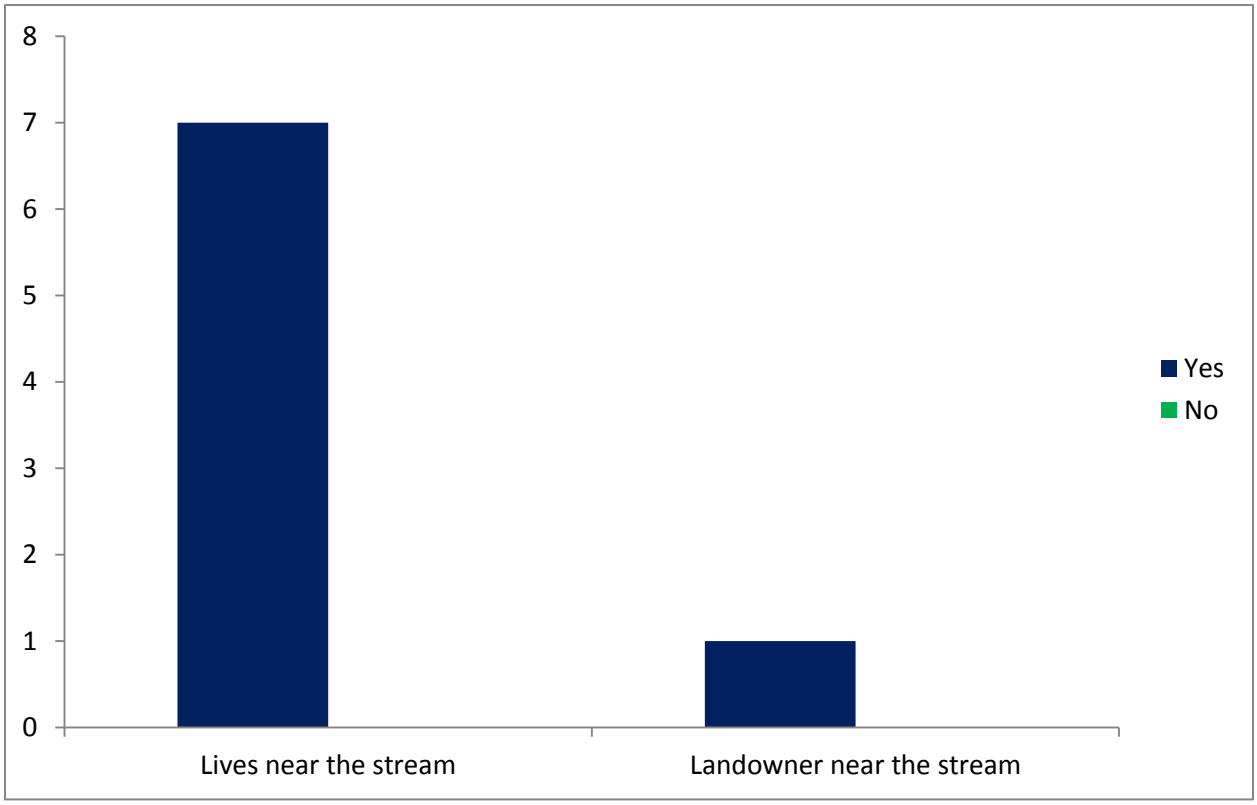

Figure 16. Number of interviewees that participated in interviews assessing recreation in Paper Mill Creek (Water body 0615A). Categories represent the reason why interviewees were selected. Yes/No indicates whether interviews were completed.

The majority of people that were interviewed have been familiar with Paper Mill Creek for 50 or more years (33%). Another 33% have been familiar with the water body for 20-50 years (Table 35). Seventy eight percent of interviewees classified the stream as perennial and 11% classified it as intermittent with perennial pools (Table 36).

Table 35. Number of years interviewees have been familiar with Paper Mill Creek (Water body 0615A).

No. of years familiar	Percentage of interviews
≤5	11%
5-<10	0%
10-<20	22%
20-<50	33%
≥50	33%

Table 36. Stream classification by interviewees which are familiar with portions of Paper Mill Creek (Water body 0615A).

Classification	Percentage of interviewees
Perennial	78%
Intermittent w/ perennial pools	11%
Intermittent	0%
Ephemeral	0%
No data	11%

Forty four percent of the people that participated in the interviews and their families use Paper Mill Creek for recreation. Among the interviewees that use the stream for recreation, 50% engage in secondary contact recreational activities (Table 37). No interviewees or their family use the stream for primary contact recreation. Secondary contact recreational activities include fishing (2 interviews).

Based on 4 interviews in which data was obtained on the number of days per year recreation occurs in Paper Mill Creek, 3 out of the 4 of the interviewees and their families recreate in Paper Mill Creek between 1 to 30 days per year (Average = 11 ± 12 days/year). Another interviewee and their family use the stream 156 days per year. Recreation in Paper Mill Creek occurs in all seasons.

Table 37. Recreational activities reported in Paper Mill Creek (Water body 0615A) that involve the person that was interviewed and or his/her family. Note that a single interviewee can report one or more recreational activities.

Personal or family uses	Number of reports
Primary contact recreational activities	
No reports of personal or family primary contact recreation	
Secondary contact recreational activities	
Fishing (For consumption)	1
General fishing	1
Noncontact recreational activities	
ATV riding	1
Hunting	3
No recreational activities	
Do not use	4

Based on the answers from four interviews, 3 interviewees do not use the stream for recreation due to poor water quality and one interviewee stated they do not use the stream due to poor access relating to private property (Table 38).

Table 38. Reasons stated by interviewees for not using Paper Mill Creek (Water body 0615A). Note that a single interviewee can report one or more reason for not using the stream for recreation.

Reasons for not using the stream	Percentage of interviews
Poor access due to private property	25%
Poor water quality	75%

Interviewees have not witnessed any primary contact recreational activities occurring in Paper Mill Creek (Table 39). One interviewee reported seeing someone fish in Paper Mill Creek. Noncontact recreational activities witnessed included riding ATVs and hunting. Based on 9 interviews, sixty seven percent of interviewees have not witnessed recreation in Paper Mill Creek.

Table 39. Recreational activities in Paper Mill Creek (Water body 0615A) witnessed by interviewees. Note that a single interviewee may report witnessing one or more recreational activities.

Witnessed Recreational Activities	Number of reports
Primary contact recreational activities	
No primary contact recreation witnessed	0
Secondary contact recreational activities	
General fishing	1
Noncontact recreational activities	
ATV riding	1
Hunting	1

Two interviewees reported hearing of primary contact recreation (swimming) on Paper Mill Creek (Table 40). One interviewee reported one instance of boating which is a secondary contact recreational activity. Noncontact recreational activities heard of included camping and hunting. Based on 9 interviews, thirty three percent of interviewees have not heard of recreation occurring in Paper Mill Creek.

Table 40. Recreational activities that interviewees have heard of occurring in Paper Mill Creek (Water body 0615A). Note that a single interviewee can report hearing of one or more recreational activities.

Recreational activities heard of occurring along the stream	Number of reports
Primary contact recreational activities	
Swimming	2
Secondary contact recreational activities	
Boating	1
Noncontact recreational activities	
Camping	1
Hunting	2

Acknowledgements

Many people contributed to the success of this Recreational Use Attainability Analysis including TCEQ Staff, and graduate students and under graduate students at Texas A&M University.

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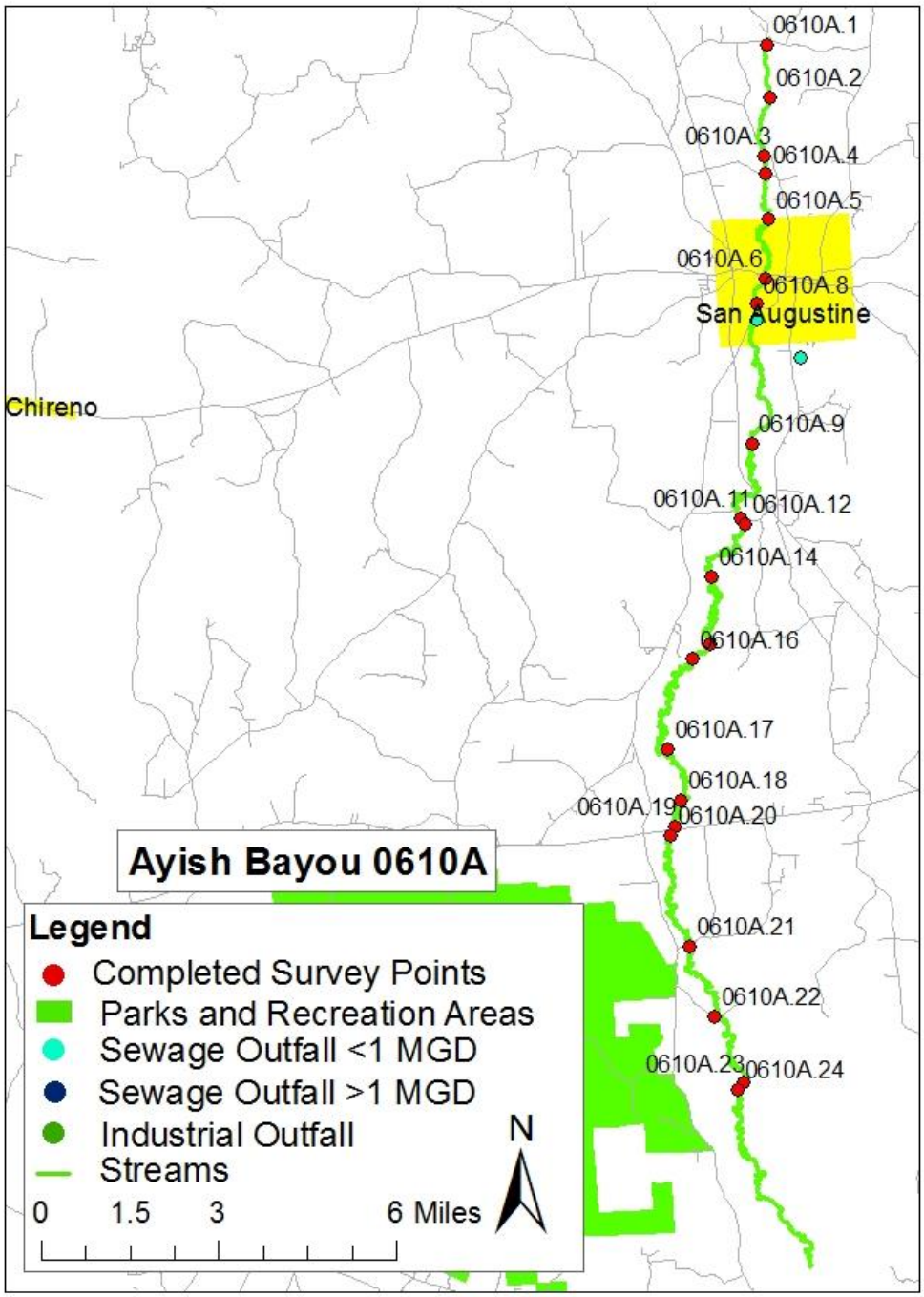
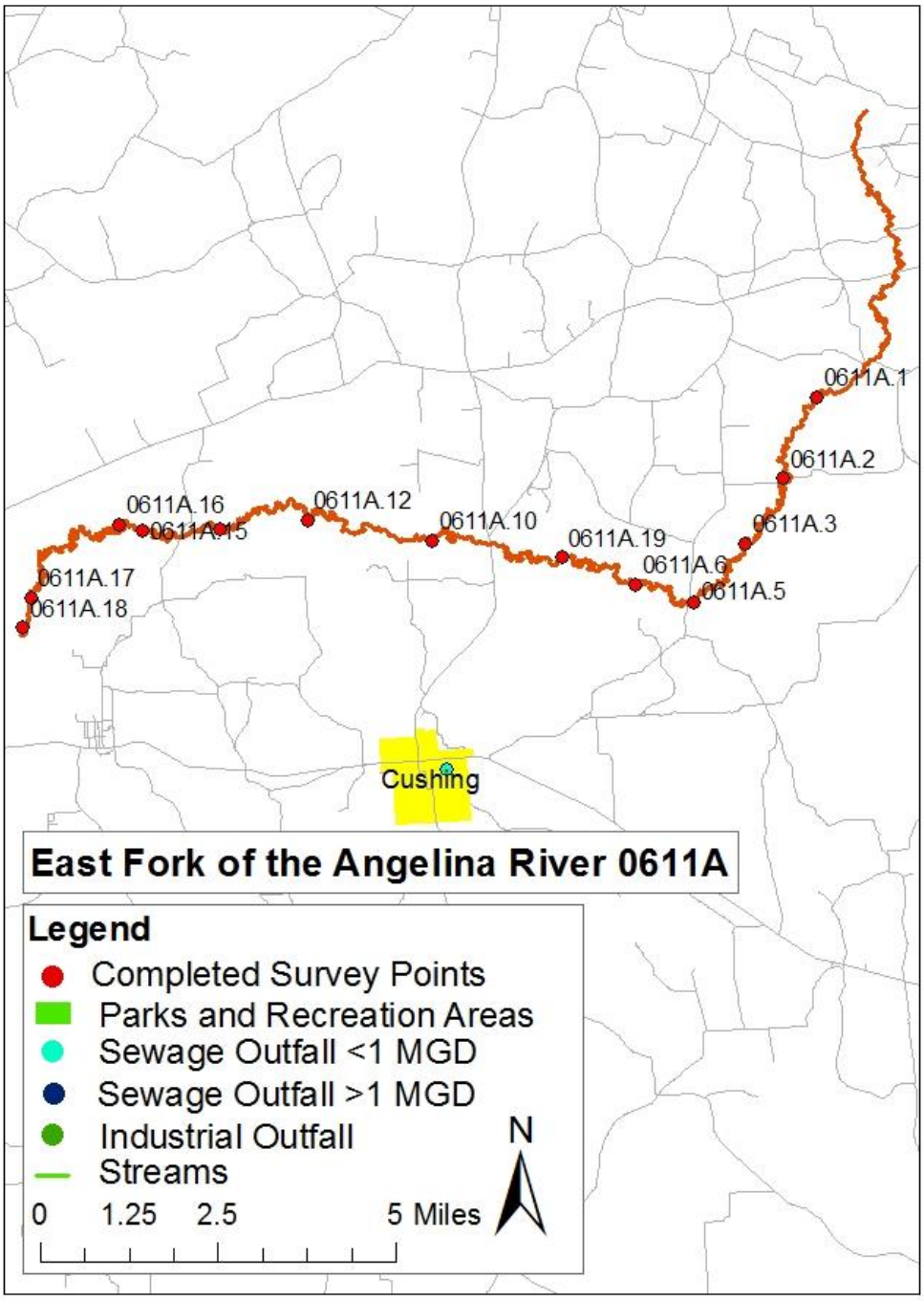
Appendices

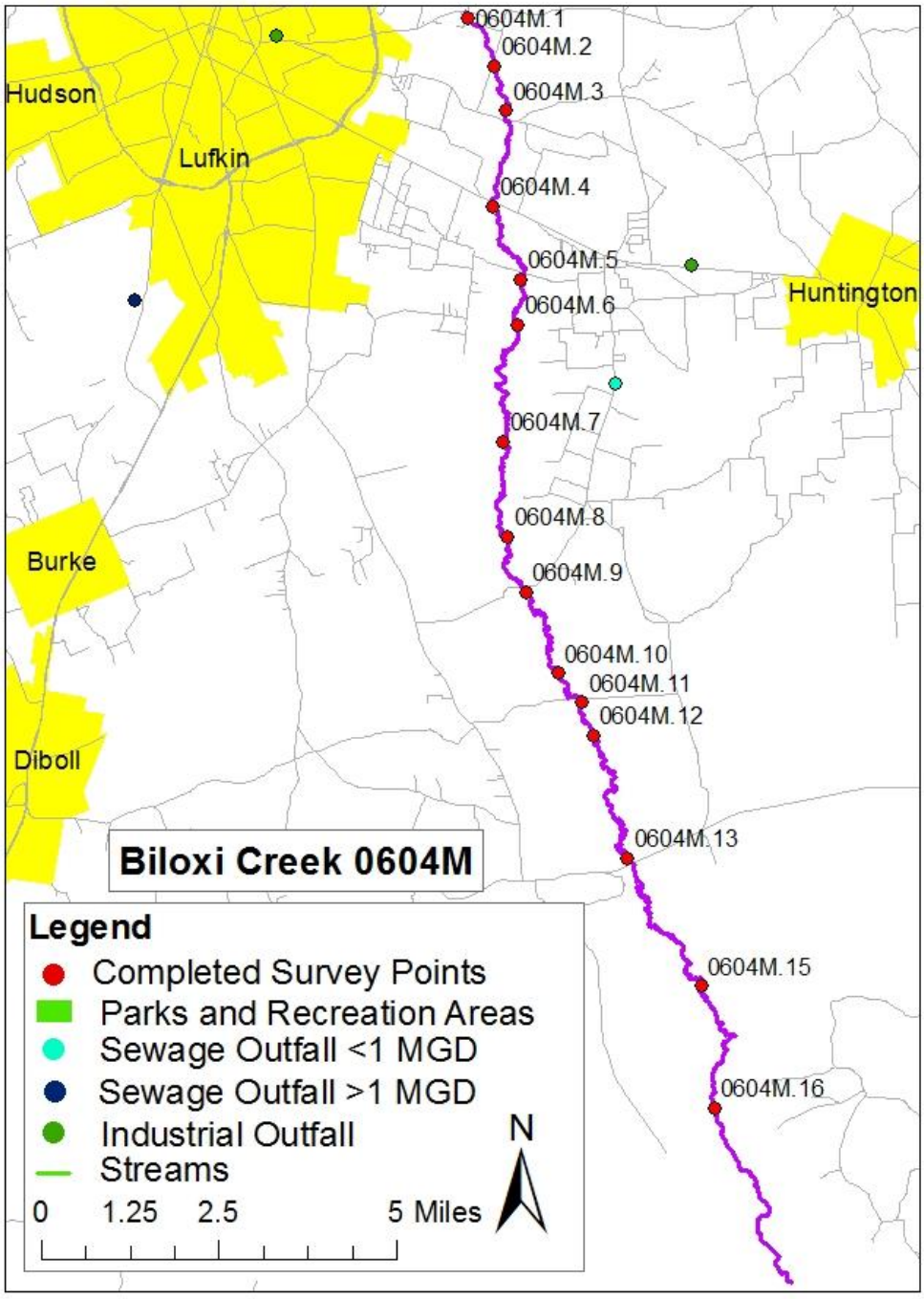
Appendix 1. Maps of study area and RUAA project streams.



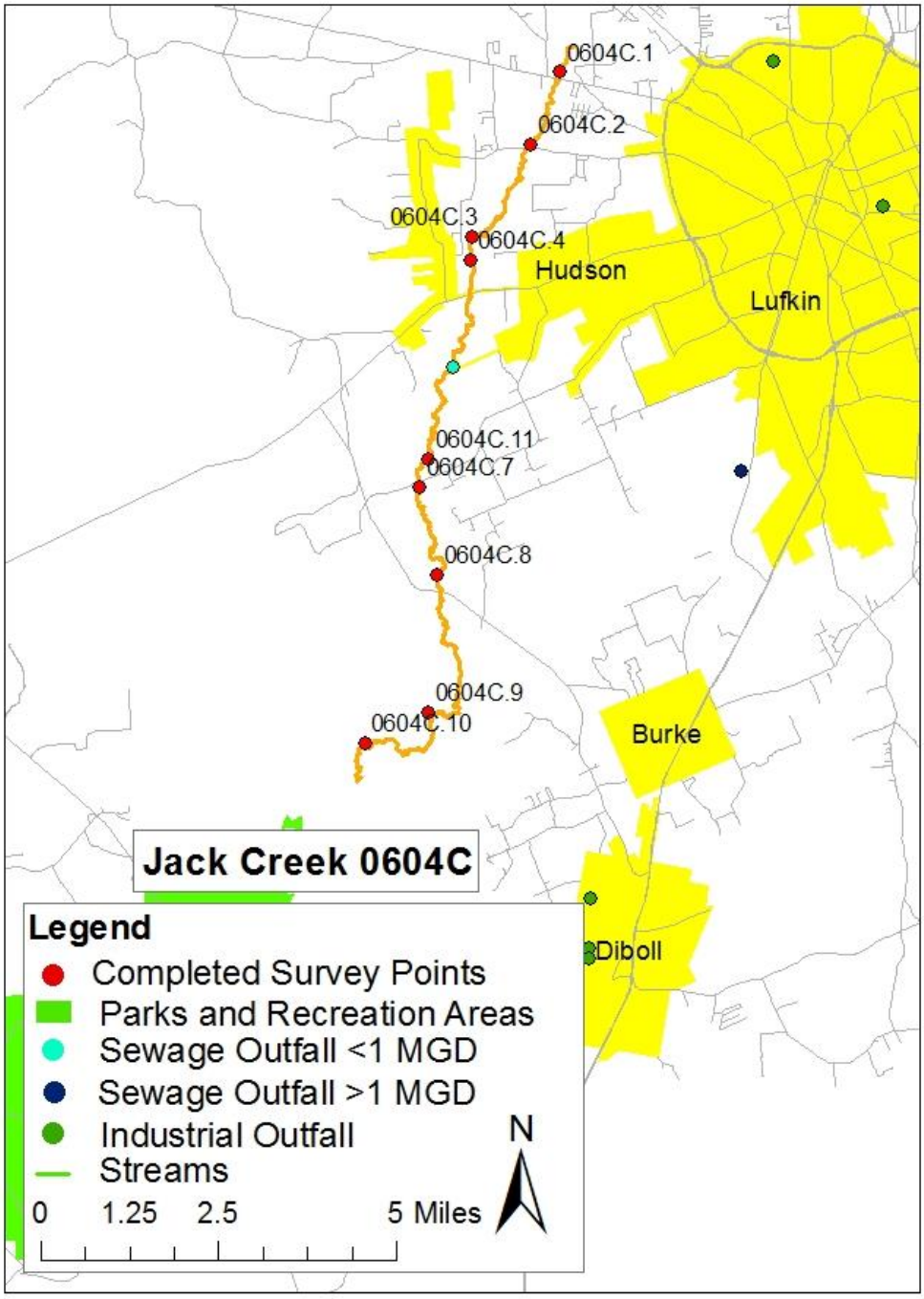
Map of completed survey sites, public recreation areas and wastewater outfalls along Ayish Bayou (0610A).



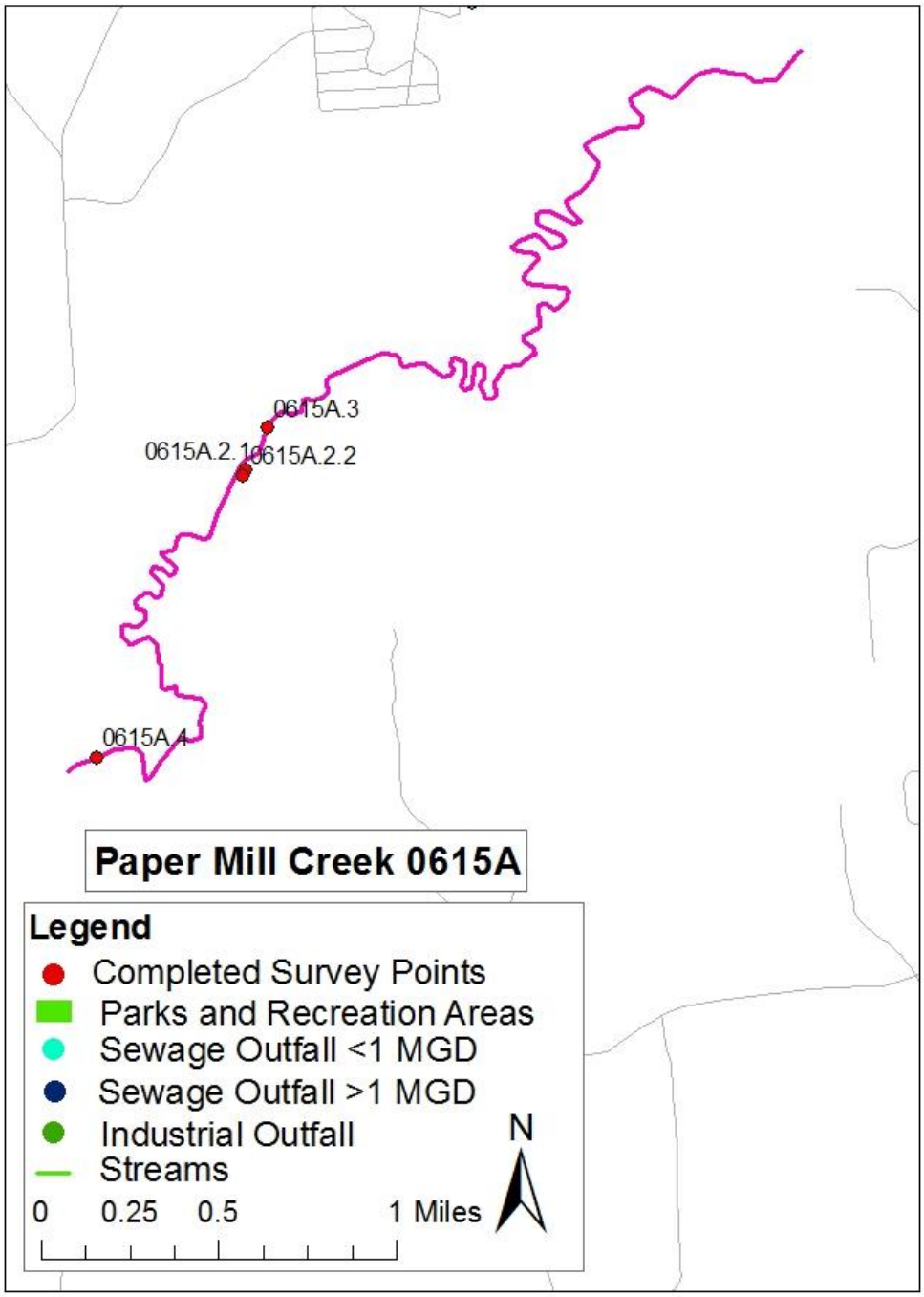
Map of completed survey sites, public recreation areas and wastewater outfalls along the East Fork of the Angelina River (0611A).



Map of completed survey sites, public recreation areas and wastewater outfalls along Biloxi Creek (0604M).



Map of completed survey sites, public recreation areas and wastewater outfalls along Jack Creek (0604C).



Map of completed survey sites, public recreation areas and wastewater outfalls along Paper Mill Creek (0615A).

Appendix 2

Contact Information Form
(This form must be completed prior to conducting a RUAA survey.)

River or stream name: _____

Notify the contacts that a recreational use-attainability analysis is being planned for the river or stream. Document whether or not the entity was notified, the name of the person contacted, and the date they were notified about the proposed RUAA project.

Required Local Contacts:

TCEQ region staff	Notified: ☐ Yes ☐ No Date: _____ Name: _____
Clean Rivers Partners (River Authority and other local partners)	Notified: ☐ Yes ☐ No Date: _____ Name: _____
Texas Parks and Wildlife Department Point of Contact: Cindy Hobson 512.389.8195 cindy.hobson@tpwd.texas.gov	Notified: ☐ Yes ☐ No Date: _____
Texas State Soil Water Conservation Board Point of Contact: T.J. Helton 254.773.2250 ext. 234 thelton@tsswcb.texas.gov	Notified: ☐ Yes ☐ No Date: _____

Suggested Additional Local Contacts to Notify (*Notify the contacts that a recreational use-attainability analysis is being planned for the river or stream. If contacted, include whether or not the entity was notified, the name of the person contacted, and the date they were notified about the proposed RUAA project on a separate page and attach it to this form*):

Local Parks and Recreation Departments	Yes ☐ No☐
Local Government/Jurisdiction	Yes ☐ No☐
Local Recreation Groups	Yes ☐ No☐
Conservation Groups	Yes ☐ No☐
Local County Extension Agent	Yes ☐ No☐
Watershed Groups	Yes ☐ No☐
Long-term Landowners/Adjacent Landowners	Yes ☐ No☐
Texas Stream Team	Yes ☐ No☐
Canoe Clubs	Yes ☐ No☐
City Commissioners Office	Yes ☐ No☐
Real estate agents	Yes ☐ No☐
Local non-profits	Yes ☐ No☐
City/county offices (Engineer, Health, Law Enforcement)	Yes ☐ No☐
Flood control districts	Yes ☐ No☐
Councils of Government	Yes ☐ No☐
TPWD Game Warden	Yes ☐ No☐
Other:_____	Yes ☐ No☐

Contact Information Form from TCEQ's 2014 Recreational UAA Procedures.

Appendix 3

Field Data Sheets –RUAA Survey

(complete for each site)

Site:

Data Collectors & Contact Information:
Date & Time: County Name:
Stream Name:
Segment No. or nearest downstream Segment No.:
Description of Site:

A. Stream Characteristics:

1. Check the following channel flow status that applies.

☐ dry ☐ no flow ☐ low ☐ normal ☐ high ☐ flooded

2. Check the following stream type that applies on the day of the survey:

☐ Ephemeral: A stream which flows only during or immediately after a rainfall event, and contains no refuge pools capable of sustaining a viable community of aquatic organisms.

☐ Intermittent: A stream which has a period of zero flow for at least one week during most years. Where flow records are available, a stream with a seven-day, two-year low-flow (7Q2) flow of less than 0.1 cubic feet per second is considered intermittent.

☐ Intermittent w/ perennial pools: An intermittent stream which maintains persistent pools even when flow in the stream is less than 0.1 cubic feet per second.

☐ Perennial: A stream which flows continuously throughout the year. Perennial streams have a 7Q2 equal to or greater than 0.1 cubic feet per second.

☐ Designated or unclassified tidal stream: A stream that is tidally influenced. If you checked this box, you will need to contact the TCEQ Water Quality Standards Group and evaluate whether or not a bathing beach is located along the tidal stream and whether or not a bathing beach is located along the estuary, bay or Gulf water that the tidal stream flows into.

3. Riparian Zone (Mark dominant categories with L (Left Bank) and R (Right Bank). Bank orientation is determined by the investigator facing downstream.)

_____ Forest	_____Urban	_____ Rip rap
_____ Shrub dominated corridor	_____ Pasture	_____ Concrete
_____ Herbaceous marsh	_____ Row crops	Other (specify): _____
_____ Mowed/maintained corridor	_____ Denuded/Eroded bank	

4. Ease of bank access to the water body: ☐ Easy ☐Moderately easy ☐Moderately difficult ☐Difficult

5. Please describe access opportunities or explain why the site is not easily accessible (Attach photos for documentation):

_____
_____
_____
_____

6. Dominant Primary Substrate

☐Cobble ☐Sand ☐Silt ☐Mud/Clay ☐Gravel ☐Bedrock ☐Rip rap ☐ Concrete

Field Data Sheet (Page 1 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

B. Primary Contact Water Recreation Evaluation:

- Primary contact recreation definition: Activities that are presumed to involve a significant risk of ingestion of water (e.g. wading by children, swimming, water skiing, diving, tubing, surfing, and the following whitewater activities: kayaking, canoeing, and rafting).

1. Were water recreation activities that involve a significant risk of ingestion (full body immersion) observed at this site?

☐ Yes ☐ No primary contact recreation activities were observed

a. Check the following boxes of primary contact recreation activities observed at the time of the sampling event at the site (Attach photos of the activities or lack of activities).

☐ Wading-Children ☐ Tubing
☐ Wading-Adults ☐ Surfing
☐ Swimming ☐ Whitewater-kayaking, canoeing, rafting
☐ Water skiing ☐ Other : _____
☐ Diving ☐ frequent public swimming-created by publicly owned land or commercial operations

b. Check the number of individuals observed at the site: ☐ None ☐ 1-10 ☐ 11-20 ☐ 20-50 ☐ greater than 50

c. Check the following that apply regarding the individuals proximity to the water body.

☐ Water in mouth or nose of the individual ☐ Primary touch: Individual's body (or portion) immersed in water
☐ Secondary touch: fishing, pets and related contact with water ☐ Individual is in a boat touching water
☐ Individual is on shore near water within 8 meters (25ft) of water ☐ Individual is well away from water between 8 and 30 meters (100 ft) ☐ Not applicable

2. If primary contact recreation activities are not observed, describe the physical characteristics of the water body that may hinder the frequency of primary contact (depth, etc.) (Attach photos, etc. for documentation).

_____
_____

3. Describe if there is public access (e.g. parks, roads, etc.) (Attach photos, maps, etc. for documentation).

_____
_____

4. Is an area with primary contact recreation activities or a bathing beach (e.g. state/local parks with swimming, etc.) located near (e.g. within 5 miles upstream and downstream) this site?

_____
_____

C. Secondary Contact Water Recreation Evaluation:

- Secondary contact recreation 1: Activities that commonly occur but have limited body contact incidental to shoreline activity (e.g. fishing, canoeing, kayaking, rafting and motor boating). These activities are presumed to pose a less significant risk of water ingestion than primary contact recreation but more than secondary contact recreation 2.
- Secondary contact recreation 2: Activities with limited body contact incidental to shoreline activity (e.g. fishing, canoeing, kayaking, rafting and motor boating) that are presumed to pose a less significant risk of water ingestion than secondary contact recreation 1. These activities occur less frequently than secondary contact recreation 1 due to physical characteristics of the water body or limited public access.

Field Data Sheet (Page 2 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name: _____ Site: _____

Date: _____ Time: _____

1. Were water recreation activities observed at the site, but the nature of the recreation does not involve a significant risk of ingestion (e.g. secondary contact recreation activities)? ☐ Yes ☐ No secondary contact recreation activities were observed

a. Check the following boxes of secondary contact recreation activities that were observed at the time of the sampling event at the site (Attach photos of activities or lack of activities).

☐ Fishing
☐ Boating-commercial, recreational
☐ Non-whitewater-kayaking, rafting, canoeing
☐ No secondary contact recreation activities were observed
☐ Other secondary contact activities: _____

b. Check the number of individuals observed at the site.
☐ None ☐ 1-10 ☐ 11-20 ☐ 20-50 ☐ greater than 50

c. Check the following that apply regarding the individuals proximity to the water body.
☐ Secondary touch: fishing, pets and related contact with water ☐ In a boat touching water
☐ Body on shore near water within 8 meters (25ft) of water ☐ Body well away from water between 8 and 30 meters (100 ft)

2. If secondary contact recreation activities are not observed, describe the physical characteristics of the water body that may hinder the frequency of secondary contact (Attach photos, etc. for documentation).
_____
_____

3. If secondary contact recreation activities are observed, how often do water recreational activities occur that do not involve a significant risk of water ingestion? ☐frequently ☐ infrequently
Please describe how often the activities occur? ☐ Unknown ☐ Never ☐ Daily ☐ Monthly ☐ Yearly

4. If infrequently, what is the reason? ☐ physical characteristics of the water body ☐ limited public access ☐ other
If other, list reasons: _____

5. Describe the physical characteristics of the water body that hinders the frequency of secondary contact recreation (depth, etc.) (Attach photos or depth measurements, etc. for documentation).
_____
_____
_____

6. Describe why there is limited public access (e.g. lack of roads, river or stream banks overgrown, etc.) (Attach photos, maps, etc. for documentation).
_____
_____
_____

D. Noncontact Recreation Evaluation

Noncontact recreation applies to water bodies where recreation activities do not involve a significant risk of water ingestion (e.g. activities with limited body contact incidental to shoreline activity, including birding, hiking, and biking), and where primary and secondary contact recreation uses do not occur because of unsafe conditions, such as barge traffic.

1. Provide site-specific information and documentation (including photographs) regarding unsafe conditions, recreation activities, and presence or absence of water recreation activities.
_____
_____

Field Data Sheet (Page 3 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

E. Stream Channel and Substantial Pools Measurements

Please check the following which best describes the river or stream (A non-wadeable stream is one that is too deep to wade. Dry streams are considered wadeable.): □ Wadeable □ Non-wadeable

1. Wadeable Streams

Determine whether or not the average depth at the thalweg is greater than 0.5 meters and if there are substantial pools with a depth of 1 meter or greater. Walk an approximately 300 meter reach (total) at the site and take the following measurements within the 300 meter reach. Measurements should be taken during dry weather flows (sustained or typical dry, warm-weather flows between rainfall events, excluding unusual antecedent conditions of drought or wet weather

Also, take photos facing upstream, downstream, left bank, and right bank at 0 meters, 150 meters, and 300 meters.

Photos #s (0 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (150 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (300 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____

a) Substantial pools - Measure the length of each pool within the 300 meter reach (if > 10 pools only measure 10 pools). Also measure the width (at the widest point) and deepest depth of each pool. A substantial pool is considered a pool greater than 10 meters in length for the purposes of a RUAA Survey. Report measurements to two significant figures. If depths are too deep to measure then report >1.5 meters.

	Length (meters)	Width (meters)	Depth (meters)
Pool 1			
Pool 2			
Pool 3			
Pool 4			
Pool 5			
Pool 6			
Pool 7			
Pool 8			
Pool 9			
Pool 10			

b)Average depth at the thalweg –Take depth measurements every 30 meters within the 300 meter reach to calculate an average depth at the thalweg (at least 11 measurements needed). Report measurements to two significant figures. If depths are too deep at a particular transect to measure then report >1.5 meters. Use 1.5 when calculating the mean.

Distance	Depth (meters)
0 meters	
30 meters	
60 meters	
90 meters	
120 meters	
150 meters	
180 meters	
210 meters	
240 meters	
270 meters	
300 meters	
Average	

Field Data Sheet (Page 4 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

c) Stream width - Measure (1) the width at one point which represents the typical average width of the 300 meter reach; (2) the width at the narrowest point of the stream within the 300 meter reach; and (3) the width at the widest point of the stream within the 300 meter reach. Report measurements to two significant figures.

Measurement Type	Width (meters)
Typical Average Width of 300 meter reach	
Width at narrowest point of the stream within 300 meter reach	
Width at the widest point of the stream within 300 meter reach	

2. Non-wadeable Streams

If accessible, take 11 width measurements which represent typical widths of the 300 meter reach. If the water is too deep the entire 300 meter reach then record the estimated average width of the water body. Report measurements to two significant figures.

Also, take photos facing upstream, downstream, left bank, and right bank at 0 meters, 150 meters, and 300 meters.

Photos #s (0 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (150 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (300 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____

# Measurements	Width (meters)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Field Data Sheet (Page 5 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

F. Additional RUAA Information. ***Summarize your observations for the entire 300 meter reach.***

1. Check the following activities observed over the site reach.

☐ Drinking or water in mouth	☐ Playing on shoreline
☐ Bathing	☐ Picnicking
☐ Walking	☐ Motorcycle/ATV
☐ Jogging/running	☐ Hunting/Trapping
☐ Bicycling	☐ Wildlife watching
☐ Standing	☐ None
☐ Sitting	☐ Other: _____
☐ Lying down/sleeping	

2. Are there permanent or long-term hydrologic modifications that are constructed and operated in a way that affects the recreational uses? ☐ Yes ☐ No (If yes, please provide supporting documentation and photos.)

Comments: _____

_____

3. Check any channel obstructions that apply (Attach photos).

☐ Culverts	☐ Fences	☐ Log jams	☐ Rip rap	☐ Water control structure
☐ Barbed wire	☐ Dams	☐ Thick vegetation	☐ Low bridges	☐ None
☐ Utility pipe	☐ Other (specify):_____			

4. Check all surrounding conditions that promote recreational activities (Attach photos of evidence or unusual items of interest).

☐ Campgrounds	☐ Stairs/walkway	☐ Roads (paved/unpaved)	☐ Other:_____
☐ Playgrounds	☐ Boating access (ramps)	☐ Populated area	☐ None of the Above
☐ Rural area	☐ Beach	☐ Docks or rafts	
☐ Residential	☐ Bridge crossing	☐ Commercial outfitter	
☐ National forests	☐ Commercial boating	☐ Trails/paths (hiking/biking)	
☐ Urban/suburban location	☐ Nearby school	☐ Power Line Corridor	
☐ Golf Course	☐ Paved parking lot	☐ Parks (national/city/county/state)	
☐ Sports Field	☐ Unimproved parking lot	☐ Public Property	

Comments:_____

_____

5. Check all surrounding conditions that impede recreational activities (Attach photos of evidence or unusual items of interest).

☐ Private Property	☐ Fence
☐ No trespass sign	☐ Barge/ship traffic
☐ Wildlife	☐ Industrial
☐ Steep slopes	☐ None of the Above
☐ No public access	☐ Other:_____
☐ No roads	

Comments:_____

_____

6. Check any indications of human use (Attach photos).

☐ Roads	☐ RV/ATV Tracks	☐ NPDES Discharge	☐ Organized event
☐ Rope swings	☐ Camping Sites	☐ Gates on corridor	☐ No Human Presence
☐ Dock/platform	☐ Fire pit/ring	☐ Children's toys	
☐ Foot paths/prints	☐ Fishing Tackle	☐ Remnants of kids' play	
☐ Other: _____			

Comments_____

_____

Field Data Sheet (Page 6 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Field Data Sheets –RUAA Survey

Stream Name_____ Site: _____

Date: _____ Time: _____

7. Please list any additional items that may impede recreation, such as excessive aquatic vegetation or algae, excessive debris, garbage, snakes, alligators, abundant wildlife, etc.? (Attach photos).

_____
_____
_____
_____

8. Please list any evidence of sustained aquatic habitat such as clam shells, aquatic or marsh vegetation, turtle shells, etc. (Attach photos)

_____
_____
_____
_____

9. Is the site located in a wildlife preserve with large wildlife (i.e waterfowl) population? ☐ Yes ☐ No

10. Please document any other relevant information regarding recreational activities and the water body in general (for example, area outside of the stream reach evaluated).

_____
_____
_____
_____
_____

Field Data Sheet (Page 7 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Severity Value	Description
☐ 1 No Flow	When a flow severity of *1* is recorded for a sampling visit, record a flow value of 0 ft/s (using parameter code 00061) for that sampling visit. A flow severity of *1* describes situations where the stream has water visible in isolated pools. There should be no obvious shallow subsurface flow in sand or gravel beds between isolated pools. "No flow" not only applies to streams with pools but also to long reaches of streams that have water from bank to bank but no detectable flow.
☐ 2 Low Flow	When streamflow is considered low, record a flow-severity value of *2* for the visit, along with the corresponding flow measurement (parameter code 00061). In streams too shallow for a flow measurement where water movement is detected, record a value of < 0.10 ft/s. ***Note:*** Use a stick or other light object to verify the direction of water movement. Make sure the movement is downstream and not the effect of wind. What is low for one stream could be high for another.
☐ 3 Normal Flow	When streamflow is considered normal, record a flow severity value of *3* for the visit, along with the corresponding flow measurement (parameter code 00061). "Normal" is highly dependent on the stream. Like low flow, what is normal for one could be high or low for another.
☐ 4 Flood Flow	Flow-severity values for high and flood flows have long been established by the EPA and are not sequential. Flood flow is reported as a flow severity of *4*. Flood flows are those which leave the confines of the normal stream channel and move out onto the floodplain (either side of the stream).
☐ 5 High Flow	High flows are reported as a flow severity of *5*. High flow would be characterized by flows that leave the normal stream channel but stay within the stream banks.
☐ 6 Dry	When the stream is dry, record a flow-severity value of *6* for the sampling visit. In this case the flow (parameter code 00061) is not reported. This will indicate that the stream is completely dry with no visible pools.

Field Data Sheet (Page 8 of 8) from TCEQ's 2014 Recreational UAA Procedures.

Appendix 4

RUAA Interview Form

Stream Name: _____ Segment #: _____ Site: _____

Interviewer's Name: _____

Date & Time (include AM or PM): _____

Interviewed: ☐ In person ☐ By phone ☐ By mail ☐ By e-mail

☐ No interviews were conducted
If no interviews were conducted, please provide an explanation:

_____

_____

*Are you willing to respond to a short survey about this stream? ☐ Yes ☐ No

Interviewee selected because (e.g., resource manager, Gov. official, conservationist, property owner, local resident, standing by stream, etc.)

_____

_____

Questions:

1. Are you familiar with this stream? ☐ Yes ☐ No If yes, how many years? _____
   If yes, proceed to #2. If no, stop here and do not conduct an interview.

2. What location(s) along the stream are you familiar with:

_____

_____

3. Have the interviewer characterize the stream flow. Since the interviewer may not be familiar with TCEQ's definitions or distinction between the different water bodies, please refer to the definitions listed below when asking this question.

☐ Ephemeral: A stream which flows only during or immediately after a rainfall event
☐ Intermittent: A stream which has a period of zero flow for at least one week during most years. (Channel contains flowing water for only a portion of the year and surface water may be absent at times.)
☐ Intermittent w/ perennial pools: An intermittent stream which maintains persistent pools even when flow in the stream is less than 0.1 cubic feet per second. (When not flowing, the water may remain in isolated pools.)
☐ Perennial: A stream which flows continuously throughout the year.

4. Have you or your family personally used the stream for recreation? ☐ Yes ☐ No
   If yes, proceed to #6. If no, proceed to #5.

5(a). List reasons stream not used. _____

_____

5(b). Proceed to #7.

Interview Form (Page 1 of 2) from TCEQ's 2014 Recreational UAA Procedures.

RUAA Interview Form

Stream Name: _____ Segment #: _____ Site: _____

6.) a) How do you use the stream? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

7. Have you observed others using this stream for recreation? ☐ Yes ☐ No
If yes, proceed to #8. If no, proceed to #9.

8. a) What kinds of uses have you witnessed? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

9. Have you heard about anyone using this stream for recreation? ☐ Yes ☐ No
If yes, proceed to #10. If no, conclude the interview.

10. a) What kind of uses have you heard about? ☐ Swimming ☐ Wading-Children
☐ Water Skiing ☐ Wind surfing ☐ Tubing ☐ Wading-Adults
☐ Hunting ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Skin Diving

b) When did these uses occur (e.g. year(s); season) and how often (times/year)?

_____
_____

c) What location did these uses occur (get specific location and mark on a map)?

_____
_____

11. Can you recommend someone else we could contact that knows the stream? ☐ Yes ☐ No
If yes, list person's contact information: _____
_____

12. Additional comments (from the interviewee or interviewer):

_____
_____

Interview Form (Page 2 of 2) from TCEQ's 2014 Recreational UAA Procedures.

Appendix 5

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: _____
Segment No. or Nearest Downstream Segment No.: _____
Classified?: _____
County: _____

1. Observations on Use
   a. Do primary contact recreation activities occur on the water body?
      frequently seldom not observed or reported unknown

   b. Do secondary contact recreation 1 activities occur on the water body?
      frequently seldom not observed or reported unknown

   c. Do secondary contact recreation 2 activities occur on the water body?
      frequently seldom not observed or reported unknown

   d. Do noncontact recreation activities occur on the water body?
      frequently seldom not observed or reported unknown

2. Physical Characteristics of Water Body
   a. What is the average thalweg depth? _____ meters

   b. Are there substantial pools deeper than 1 meter? yes no

   c. What is the general level of public access?
      easy moderate very limited

3. Hydrological Conditions of site visits (Based on Palmer Drought Severity Index)
   Mild-Extreme Drought Incipient dry spell Near Normal Incipient wet spell Mild-Extreme Wet

RUAA Summary Sheet (Page 1 of 1) from TCEQ's 2014 Recreational UAA Procedures.